

A BIBLIOGRAPHY OF FISHES

A BIBLIOGRAPHY OF FISHES

BY
BASHFORD DEAN

EXTENDED AND EDITED BY
EUGENE WILLIS GUDGER

WITH THE COÖPERATION OF
ARTHUR WILBUR HENN

VOLUME III

INCLUDING INDICES, GENERAL BIBLIOGRAPHIES, PERIODICALS
RELATING TO FISHES, EARLY WORKS, VOYAGES AND EXPE-
DITIONS, ADDENDA, AND ERRATA OF VOLUMES I AND II



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“THE BOOKES REQUEST

Reede ouer, then judge,
Condemne not before:
With iudgment iust reiect,
Or els imbrace my lore.
Mine Authour was the first
And last, as I suppose,
That euer did assay
These secrets to disclose,
If ought be wrought awry,
And seems to thee vnsounde,
With penne I pray amende,
And not with tongue confounde.”

The publisher's prefix to the English version of Janus Dubravius's
“A new booke of good husbandry.” London, 1599.

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THE following comments of writers, gathered in miscellaneous reading, seem fittingly to express our sentiments at different times while we were compiling the present volume. Now that our *opus* is completed, we may be forgiven for recording them:

B. D.

"Deep calleth unto deep at the noise of thy waterspouts: all thy waves and thy billows are gone over me."

42nd Psalm.

Tetzel the Bohemian, gazing at the sea at Cape Finisterre, remarked, — as if he had our bibliography in his mind's eye — "The end of it no one knoweth, save God alone!"

The Bohemian Ulysses (1477);
MRS. HENRY CUST, *Gentleman
Errant*, 1907, p. 87.

"I truly believe that in the sea there is abundance of infinitely admirable things, whereof God alone hath knowledge."

LAURENT VITAL in *Voyage de
Charles Quint*, 1518.

"But to describe the [fishes, the] subtleties, the many strange devices and order in the same, I do lack wit in my gross old head and cunning in my bowels to declare the wonderful and curious imaginations in the same invented and devised."

CAVENDISH'S *Wolsey*, 1556
(Routledge ed. 1885, p. 106).

"A painful work it is I'll assure you, and more than difficult, wherein that toyle hath been taken, as no man thinketh so no man believeth, but he that hath made the triall."

ANTHONY A WOOD in the Preface
to his *History of Oxford*.

"Such an enterprise is thankless for the one who charges himself with it; but it can be received with some favor by those naturalists whose researches are facilitated by it."

Note by HIPPOLYTE CLOQUET
appended to his *Fish Bibliography*, 1821.

"No extended record of facts grows too old to be useful provided only that we have a ready and sure way of getting at the particular fact or facts we are in search of. And this leads me to speak of what I conceive to be one of the principal tasks to be performed by the present and the coming generation of scholars, not only in the medical, but in every department of knowledge. I mean the formation of indexes . . ."

OLIVER WENDELL HOLMES.

"The history of a science is the palladium of its freedom; it prevents it from being tyrannized over by narrow bigoted viewpoints."

Motto which appeared with a
lithographed portrait of Ludwig
Choulant in 1842.

PREFACE TO VOLUME III

THE present volume concludes the Bibliography of Fishes, and in it is the test of the practical value of our task, which is its highly developed Index. For the reader who seeks information relating to fishes should be able promptly and easily to put his finger on whatever has been written on his theme, — whether it deals with fishes living or fossil, their distribution, physiology, anatomy, development, teratology, their life-habits, minute structure, commercial importance, artistic interest, food-value, or their significance in biological economy. In fact it is our hope that such a Bibliography will be useful not to ichthyologists only but to seekers of knowledge everywhere.

Thus the chemist who studies egg-yolk, the sanitary engineer who aims to destroy disease-bearing insects, the physiologist who seeks data on the regeneration of nerves, the student of the cancer problem, the anthropologist who describes the life-habits of primitive peoples, the bacteriologist whose work touches diseases in fishes, the medical practitioner who would know the earlier hosts of certain parasites or about oils digestible to his patients — even the amateur of heraldry, or the theologian — each and all of these will here find materials which concern his work.

If the reader will refer to the table of contents mapped out for the Bibliography in Volumes I and II he will note that hitherto were published only (I) Authors' Lists of Titles and (II) Anonymous Publications. There remained (III) Pre-Linnæan Works, (IV) General Bibliographies which included references to Fishes, (V) Voyages and Expeditions, (VI) List of Periodicals relating to Fish and Fish Culture, (VII) Subject Index of Authors' Titles and Final Index, and (VIII) Addenda and Errata of Volumes I and II.

Those headings, then, (IV) to (VIII), will be found in the present volume. The original plan has been changed only in detail. Thus headings (VII) and (VIII) have been transposed for convenient reference, and the Addenda (placed at the beginning of Vol. III) have been enlarged by introducing themes (*e. g.* fisheries or fishing methods) which earlier for specific reasons had been largely omitted. In fact, it was found that the work was undergoing an evolution of its own,

on the one hand broadening its scope and on the other including even more minute details. In the former regard the editors were frequently puzzled to decide where to lay down an ultimate boundary, *e. g.* to determine whether certain groups of titles should be subdivided, rearranged or even rejected.

EXPLANATION OF MATERIALS IN THE PRESENT VOLUME

Of sections (III) to (VI) little need here be said. The *Pre-Linnæan Literature* (III) (from the earliest writings up to 1758) is cited in detail and only after laborious research. In gathering this material the works themselves have in many cases been scrutinized even to their revisions and versions, those in English checked largely after the studies of Lowndes. The earliest papers on Angling and Pisciculture follow in the main the work of Westwood and Satchell. And for the reader's convenience extremely rare works are noted as occurring in definite libraries.

Regarding *Errata and Corrigenda* (VII), a more detailed examination of bibliographies cited in special memoirs has yielded additional titles and has enabled us to correct defective citations. On the other hand, as is often the case in bibliography, we have found that lists of works cited in special memoirs are usually, if not always, seriously defective; even in so special a study as the list of papers of Dr. Gill, prepared by the Smithsonian, thirty-two titles were missed which we had earlier collected, while, truth to tell, it contained about twenty titles which were not on our cards. Or in the instance of so scholarly and detailed a work as Gemmill's "Teratology of Fishes" we have been able by consulting a greater range of authors to increase its number of references by no less than one-fourth. Another example is in Ackermann's (K. 1898.1) studies of hybrids among fishes where only nineteen hybrids are recorded, while the present work enumerates over fifty (including, of course, later citations). In general it will be found that our titles end with the year 1914 — which marks a convenient international stopping point as a result of the Great War. It is true that a number of later papers are cited in our pages, but these only for special reasons — as in rounding out the bibliographies of writers who since have died (*e. g.* Eastman, Steindachner), or in completing outstanding works (*e. g.* Jordan's "Genera" or Boulenger's "Fishes of Africa"). In certain instances where especially important papers had appeared they have been cited in our Subject Index.

The *Alphabetical Index of Subjects* (VIII) requires a long explanatory note. Indeed it is clear that the diverse materials sifted from a vast number of references, nearly fifty thousand, could not, in the nature

of things, be reduced readily to a well ordered index. Nor was it an easy task to classify the themes of each paper for purpose of reference. Hence it may be well here to explain the steps or stages which the editors followed in their task. The *first stage* consisted in placing the dissected pages of Volumes I and II and other Authors' Titles on the tables of the members of the editorial staff, dividing the materials so far as possible in accordance with the special studies of the various workers, who could now note at the side of each title as printed the captions under which it should be indexed — which meant, in practice, that the same paper would usually be cited under numerous headings. The *second stage* in indexing was to prepare a separate card for each heading as noted above, not citing, however, the full title of the paper, but giving only the author's name and the date and order of his publication, by means of which the reader could at once locate the exact title in Volumes I or II. The *third stage* brought together cards of similar captions and filed them in large trays in an elaborately subdivided card catalogue of subjects. The *fourth stage* consisted in the editing of all material thus classified. In thousands of instances where there was doubt as to actual contents the original papers were examined, titles revised and errors corrected. In very many cases authors were found to have given inadequate descriptions of their work and these were corrected. Thus, who would have known from its title-page that the work of Dabry de Thiersant (1872.1) had anything to do with the fish fauna of China, or from the title of Mark's paper (1890.1) on the ganoid *Lepidosteus* that it was to become the standard reference for the egg-membranes of Teleosts? Unfortunately, it was not practicable to examine every paper, and for this reason there will be found numerous errors of omission in our work. For the papers of the United States Fisheries Commission we had not then at hand the admirable index prepared by Miss MacDonald, which would have saved us much time in "checking up" our cards; on the other hand, careful use was made of earlier bibliographies of which in all over fifty thousand pages were taken into account.

The *fifth stage* in the growth of the Index was the introduction of an "honor system": the reader should be told what papers were the best in his field, and the first which he should consult. To this end the asterisk, familiar to all in Bædecker's guide-book, was brought into play, although never carried to the degree of introducing double "stars" at the head of each name and title. Such a mark, then, denotes an excellent paper, generally accessible, and with references up to date. Inaugural dissertations do not come into account here, for they are often printed privately and are rare. In case the paper is

a classical one, like Agassiz's "Poissons Fossiles," or Johannes Müller's "Myxinoiden," or is the most important one upon a subject, it is printed in black face type. It is obvious, of course, that our estimate of the value of a particular paper may not be just, but the general reader will probably be willing to take chances, and in case he finds us in error we must console ourselves with Newton's complacent dictum that "it is impossible to print a book without faults."

The *sixth stage* in preparing the Index was decided upon only after numerous conferences: should the arrangement form a dry-as-dust conventional index or should it be classified, with references so grouped as to give the reader at one time and in one place materials for selection. Of many headings, too, summaries and introductions were recommended. This general procedure, it was agreed, would give an encyclopedic value to our work, but it would also entail vast labor upon our staff. It meant that the references of the bibliography in their vast number be again sifted over, and many of them boiled down for citation. Such a task the editors next attacked and they have now brought it to a successful conclusion — cheered not a little by the favorable comments of critical bibliographers — such a national expert, for example, as Dr. Lydenberg of the New York Public Library noting that a work on such lines "would have no parallel in the history of science," — which is praise indeed! Certainly of no other branch of the Animal Kingdom is there known to us as complete a compendium of the literature or one so minutely digested for the reader.

It became clear also that the *sixth stage* in the work, which assured to it an Annotated Index, would have to be followed by a *seventh*, which was to compile in the end *an index of our index* (VIII). This, it was agreed, would prove more or less of a secretarial undertaking. It meant, nevertheless, that the editors should indicate in the Annotated Subject Index all words or themes which should be placed in alphabetical order in the Final Index. Thus in the Subject Index, such a theme as "Egg" should be considered in general and in detail, *in rebus* membranes, yolk, nucleus, etc., and under each caption would naturally appear many technicalia — but arranged in their natural, not in their alphabetical order, *e. g.* permeability, micropyle, etc. But even thus arranged these names would not be so scattered that the reader would have trouble to find them; for he could pick them up at definite pages in an *alphabetical list at the end of the volume*.

There were certain guiding principles which were laid down during the progress of the work:

(a) Regarding *species, genera and many families* of living and fossil fishes we could not attempt to cite purely systematic references in

greatest detail. There have been described probably twenty thousand kinds of fishes and to each of these are many references, in certain cases hundreds and even thousands. To attempt, therefore, to include them in the present work was hardly practicable; for one thing, it would entail years of added labor and extra volumes. Moreover, such a labor seemed to the editors the less necessary since it is the particular branch of the subject which has already been given the greatest attention. Hence the student of the systematique is here referred only to general works. *In a word, the present volume leads the investigator through the literature of the fishes only so far as families and genera: it records species rarely.*

Only in instances of rare and unusual fishes have we cited the literature *in extenso*, e. g. deep-sea fishes of especial interest in morphology or physiology, or fishes of restricted localities. For new species the reader must still consult his Zoölogical Record. For genera he has now the splendid work of Jordan (1917.1). None the less, he will here find references to extensive papers which cite new species in considerable number, together with many useful taxonomic revisions and synopses. His further systematic details he must continue to "run down" in Jordan and Evermann's "Fishes of North and Middle America," Boulenger's "Fishes of Africa," Day's "Fishes of India," etc., Gunther's "Catalogue [1859-70] of the British Museum," for living fishes, and Smith Woodward's for fossil [1889-1901], the latter forming the "Bible" of all students of this theme. In the last regard it will be found that the detailed indexing of fossil teeth has been largely omitted, though fossil spines, ichthyodorulites, have been included. In a word, the compilers have tried, so far as possible, not to reprint needlessly the classical work of systematists, or to re-index such publications as the Zoölogical Record or the cards of the Concilium Bibliographicum.

(b) In matters of *Synonymy* we have not attempted to decide questions of priority in nomenclature: we have accepted a name as an author has given it, save in case its synonymy was obvious. In general we have been content to follow technical names which are well known.

In the case of *Group-names*, e. g. Ganoidei, we have sometimes for convenience followed older and popularly accepted terms and for the same reason we have adopted the groups for classification given in Cambridge Natural History (1904). These at least are clear and accessible; and although we do not personally subscribe to them *toto cælo*, we feel that our present function is rather to place in the reader's hand sources of information than to decide for him which kind of classification he should ultimately adopt.

Regarding acknowledgments:—The early history of the present undertaking has already been recorded (Vol. I, viii-ix). In 1917 the United States entered the war. In this year, fortunately, Volume II was published before the editors were able to find their way into the service of the Government. Dr. C. R. Eastman was presently ordered to Washington and elsewhere, Mr. Arthur Henn enlisted for France and the writer "joined up" with the ordnance department. Then in September, 1918, occurred the lamentable death of Dr. Eastman (*cf.* Science, Feb. 7, 1919, pp. 139-141), which the writer believes was a direct result of his activities in the war. It was upon him, as we have noted, that the responsibility of editorship had fallen in earlier years (from 1914 to 1917), and it was under his care that Volumes I and II were published.

In 1919, Dr. Eugene Willis Gudger, long time Professor of Biology in the North Carolina College for Women, and our constant correspondent and adviser, consented to become the editor of the Bibliography, much to the satisfaction of his friends in the American Museum. His contributions to the Bibliography include the extensive Addenda; expanding and completing the Pre-Linnæan literature; adding the smaller sections of Bibliographies, Voyages and Travels, Fisheries Journals, and Errata and Corrigenda; certain parts of Morphological Section, and most of the groups in the Systematic Section. And it was by a second stroke of good fortune that we were able again to enlist the help of Mr. Arthur W. Henn on his return from active service: such an arrangement could not have been made without the generous coöperation of Director Holland of the Carnegie Museum of Pittsburgh, in whose faculty Mr. Henn had become curator of fishes. Mr. Henn, we should note, prepared the reference cards and developed the Subject Index; he also is responsible for most of the subjects given in the Morphological Section, and especially for all the encyclopedic articles; and for the most complicated groups of the Systematic Section, *i. e.*, Anguilla, Pleuronectidæ, and Salmonidæ. In addition, the staff of the Bibliography included Miss Francesca La Monte, who stuck to her task with the greatest devotion and who prepared the Finding Index.

We should note also that helpful comments were received from a number of our ichthyological friends who were so kind as to read sections of page-proof, notably Professor E. S. Goodrich of Oxford, whose comments on dermal skeleton, fins and integument are below included; also Professor J. Graham Kerr of Glasgow, whose advice was sought in the technicalia of dentition, growth and age, urinogenital system, and vertebral column.

Especial acknowledgment should be made to the President of the American Museum, Professor Henry Fairfield Osborn, who, firm in the faith of the ultimate value of our labors, stood our sponsor in obtaining the funds necessary to ensure the stipends of the editorial staff and to cover the large outlay for publication. Also to the Director of the Museum, Dr. Frederick A. Lucas, to its Librarian, Dr. R. W. Tower, and to our colleagues Mr. John Treadwell Nichols, and Professor W. K. Gregory, we are indebted for constant counsel and for help in many directions. Nor should we fail to mention the favors shown us by authorities of numerous libraries and universities, notably Dr. H. M. Lydenberg of the New York Public Library.

The author finally and gratefully records the constant inspiration received from his editorial colleagues with whom since 1919 he had weekly conferences. Entangled in other studies, he could only give the necessary time to mark his share of the copy for the Subject Index, to revise proof, and to review and decide discussions which concerned the conduct of the work.

The present volume terminates a task, infinitely painstaking, thankless, insistent, withal necessary, which has been upon our table for over thirty years. It seemed never to end, and we grew old with it; *Quousque tandem!* Our hope is only that the references we now provide will be of constant service to workers everywhere, for when all is said and done, an elaborate bibliography is the strongest scaffolding upon which any research can be built.

BASHFORD DEAN.

American Museum of Natural History.
January 15, 1923.

LOCATION OF RARE BOOKS

A list of American libraries in which may be found certain of the rare books listed in the Pre-Linnæan section, together with the abbreviations herein used.

A. G. S.	— American Geographical Society, New York City.	J. P. M.	— Library of J. P. Morgan, New York City.
A. M. N. H.	— American Museum of Natural History, New York City.	L. C.	— Library of Congress, Washington, D. C.
A. P. S.	— American Philosophical Society, Philadelphia, Pa.	N. Y. A. M.	— New York Academy of Medicine, New York City.
A. T. M.	— American Typographic Library and Museum, Jersey City, N. J.	N. Y. P.	— New York Public Library, New York City.
ARN.	— Arnold Arboretum, Cambridge, Mass.	N. W.	— Northwestern University, Evanston, Ill.
B. A.	— Boston Athenæum, Boston, Mass.	P. A. S.	— Philadelphia Academy of Science, Philadelphia, Pa.
C. P.	— College of Physicians, Philadelphia, Pa.	P. I.	— Peabody Institute, Baltimore, Md.
COL.	— Columbia University, New York City.	P.	— Princeton University, Princeton, N. J.
COR.	— Cornell University, Ithaca, N. Y.	STAN.	— Stanford University, California.
H.	— Harvard University, Cambridge, Mass.	SURG.	— Surgeon General's Library, Washington, D. C.
H. E. H.	— Library of Henry E. Huntington, San Gabriel, California.	U. C.	— University of Chicago, Chicago, Ill.
H. W.	— Library of Henry Walters, Baltimore, Md.	U. PA.	— University of Pennsylvania, Philadelphia, Pa.
J. C.	— John Crerar Library, Chicago, Ill.	U. R.	— University of Rochester, Rochester, N. Y.
J. C. B.	— John Carter Brown Library, Providence, R. I.	U. S. C.	— University of South Carolina, Columbia, S. C.
J. H. U.	— Johns Hopkins University, Baltimore, Md.	U. T. C.	— Union Theological Seminary, New York City.
		Y.	— Yale University, New Haven, Conn.

CONTENTS OF VOLUME III

II. A. LIST OF ANONYMOUS TITLES CONTINUED FROM VOL. II, P. 702	1- 3
B. ADDENDA TO TITLES CONTAINED IN VOLS. I AND II	4-203
III. TITLES OF PRE-LINNAEAN PUBLICATIONS — <i>i. e.</i> , <i>before</i> 1758	204-338
IV. GENERAL BIBLIOGRAPHIES WHICH INCLUDE REFER- ENCES TO FISHES	339-342
V. VOYAGES AND EXPEDITIONS WHICH RELATE TO FISHES	343-347
VI. LIST OF PERIODICALS RELATING TO FISH AND FISH- CULTURE, WITH THE ABBREVIATIONS HEREIN USED	348-353
VII. ERRATA AND CORRIGENDA OF VOLUMES I AND II . .	354-360
VIII. SUBJECT INDEX:	
MORPHOLOGICAL AND GENERAL SECTION, AR- RANGED UNDER 118 SPECIFIC AND TECHNICAL HEADINGS	361-614
SYSTEMATIC SECTION, INCLUDING NATURAL HIS- TORY AND OCCURRENCE, AND TAXONOMY OF VARIOUS GROUPS OF FISHES AND OF CERTAIN SPECIFIC FISHES	615-665
FINDING INDEX, ALPHABETIZING ALL THE MATE- RIALS IN THE MORPHOLOGICAL AND SYSTEMATIC SECTIONS OF THE SUBJECT INDEX	667-707

EXPLANATORY NOTE

I. For economy in publication, titles have been simplified; words and punctuation marks have been omitted where they appeared unnecessary for a clear understanding of references.

II. Rules of the American Library Association have been followed as to (1) alphabetizing, and (2) transliteration of Slavonic names, with vowels as in Italian and consonants as in English. In addition, initial capitals in foreign languages are unaccented, as for instance Abo for Åbo, Etat for État, etc., and Danish and Norwegian nouns are not capitalized.

III. Additions to titles or inserted explanatory phrases are included in inferior brackets {}, parentheses being retained where they occur in titles.

IV. The number of the volume is printed in bold-faced type, immediately succeeding the numerals denoting year of publication.

V. Authors' titles are arranged chronologically as to years and alphabetically as to publications within the same year.

VI. Where titles have been taken from standard works of reference (*e. g.*, British Museum Library Catalogue and the bibliographies of Agassiz, Bosgoed, Carus, and Englemann, etc.) the numbers for pages and volume have not as a rule been verified.

BIBLIOGRAPHY OF FISHES

II

A. LIST OF ANONYMOUS TITLES

*Continued*¹

Anonymous. Abbildung und Beschreibung der Fische. Nürnberg, 1787. pls. 8°. Anon. 651

— Account of a very extraordinary fish, called the Sea-Devil (*Rana piscatrix*) in a letter from a gentleman at Genoa on his travels, to his friend in England. N. London Magaz., Suppl. to vol. 1, 1785. Anon. 652

— Allgemeine Betrachtung über die Fische. Neuesten Mannigf., 1781, 4, 513. Anon. 653

— Biological notes. Bull. U. S. Fish Comm. 1899 (1900), 305-310. Anon. 654

Short notes on fishes at Woods Hole.

— The black bass (From "American Field") 19. Ann. Rept. Comm. Inland Fisheries Massachusetts 1884 (1885), 56-60. Anon. 655

— The book of fishes. Class Pisces. London, 1851. illust. 24°. Anon. 656

For earlier ed., See Anon. 110.

— Canetons (Ducklings) mangés par une truite. La Pisciculture Pratique, 1899, 5, no. 11, 200. Anon. 657

— [Sale] Catalogue of the library of . . . John Gerard Hecksher. 3 parts. New York, 1909. 146, 146, 89 p. Anon. 658

2442 items listed in ichthyology, angling and fisheries.

— Ceylon: a general description of the island, historical, physical, statistical: containing the most recent information. By an officer, late of the Ceylon Rifles. 2 vols. London, 1876. Anon. 659

Fishes, vol. II, 242-268.

— Christfische [alte Sitte in Nürnberg] Deutsch. Fischerei-Zeitg., 1912, 35, 695. Anon. 660

— The complete fisherman; or, universal angler. Containing full directions for taking all kinds of river fish; . . . likewise a compendious account of the principal sea-fish. 2nd ed. London, 1778. Anon. 661

This passed through at least 4 eds., all undated; the fly leaf of the second ed., however, is inscribed 1778.

— Cours d'histoire naturelle ou tableau de la nature considéré dans l'homme, les quadrupèdes, les oiseaux, les poissons, les insectes &c. 7 vols. Paris, 1770. pls. 12°. Anon. 662

Abstracts in Journ. Encycl., 1770, 7, 456. — Gött. Gel. Anz., 1771. Another ed., 7 vols., Paris, 1795.

— Daten zur Urfischerei Siebenbürgens. II Theil. Urfischerei in den Seen der Mezözög. Anz. Ethnog. Abth. Ungarisch. Nat. Mus., 1902, Beibl. 1, 1. Jahrg., 40-52. Anon. 663

Illustrated with 20 figures of fishing apparatus.

— De gymnoto stuporifero Surinamensi; vim suam amittere ad magnetis accessum. Berlin. Samml. 1770, 2. Anon. 664

— Description d'un huso monstrueux. Acta Acad. Petropolit., 1777, pt. 1, 80. Anon. 665

— Descriptive catalogue of the Japanese fishing industry, prepared for the World's Fair, St. Louis, by the Imperial Fisheries Bureau, Department of Agriculture. Tokyo, 1904. 33 p. 8°. Anon. 666

¹ Initial articles ("a," "an," "the," etc.) in English and in foreign languages are disregarded in alphabetizing, and the titles are numbered serially for the purpose of reference in the Subject Index. For previous list of Anonymous Titles, numbers 1-650, see volume II, p. 677-702. For Anonymous Titles before 1758, numbers 713-786, see in Pre-Linnæan Section this volume, p. 334.

— Extraordinary growth of a pike. *Mag. Nat. Hist.*, 1830, **3**, 147.

Anon. 667

— Feeding cattle on fish. *Barnstable Journal* (Cape Cod, Mass., U. S. A.) 1833, (February 7).

Anon. 668

— Die Fischerei der Eingeborenen in Kamerun. *Fischerbote*, 1913, 5. Jahrg., 152-.

Anon. 669

— Fischerei und Fischzucht in Russland. Schweiz. *Fischerei-Zeitg.*, 1912, **20**, 174-.

Anon. 670

— Fischereiverhältnisse in Beludschistan. *Deutsch. Fischerei-Zeitg.*, 1912, **35**, 543.

Anon. 671

— Fischereiverhältnisse in Bosnien und der Herzegowina. *Oesterr. Fischerei-Zeitg.*, 1912, **9**, 388-406.

Anon. 672

— Fische und Fischfang in Britisch-Guyana. *Deutsch. Fischerei-Zeitg.*, 1913, **36**, 267, 268, 289-291, 304-306; 318-319.

Anon. 673

— Fischgeräte der Steinzeitleute. Schweiz. *Fischerei-Zeitg.*, 1912, **20**, 305-.

Anon. 674

— The fish supply of London. *London Quart. Rev.* 1882, no. 308, 231-242. — *Rept. U. S. Fish Comm.* 1881 (1884), **9**, 643-661.

Anon. 675

See also Walpole, S. Add. 1882.1

— The flight of flying fishes. *Lt.-Col. Durnford's arguments. Knowl. & Sci. News*, 1906, n. s. **3**, (29), 603-604.

Anon. 676

See Durnford, 1906.1 & 1906.2.

— Forskjelligt om fortplanting og ynglepije hos koldblodige hvirveldyr. (. . . Sydamerikanske padder og ferskrandsfiske. . . .) *Tidsskrift Populaera Fremstill. Naturvidensk., Femte Række*, **1**, 1874.

Anon. 677

Reviews a number of older accounts of oral gestation.

— Die Grenzverhältnisse im Bodensee, und ihrer Einfluss auf die Fischerei. Schweiz. *Fischerei-Zeitg.*, 1911, **19**, Heft 4, 87-91.

Anon. 678

— Handbok för fiskare, innehållande: Tillförlitlig underrättelse om alla vid Svenska stränderna bekanta fisksorter och sättet till deras fångande, jemte beskrifning på de fiskredskap,

som der till användas. Stockholm, 1842. 12°.

Anon. 679

— Has the fish a memory? *Lancet*, 1897, **1**, 552.

Anon. 680

— Histoire de l'industrie de la pêche maritime et fluviale au Japon par le bureau des produits maritimes et fluviaux du Ministère de l'Agriculture et du Commerce, redigée pour l'Exposition Universelle de Paris en 1900. Tokyo, 1900. 8°.

Anon. 681

— Historisches aus Oldenburgs Fischerei. *Mitth. Landes-Fischerei Ver. Herzogtum Oldenburg*, 1912, **2**, 32-34.

Anon. 682

— Incubazione boccale dei pesci. *Neptunia, Venezia*, 1903, **18**, 277-278.

Anon. 683

— Die Küstenfischerei in Daresalam. *Fischerbote*, 1913, 5. Jahrg., 166-.

Anon. 684

— Natürliche Geschichte des Herings. *Hamburg. Magaz.*, 1759, **23**, 563-583.

Anon. 685

— Naturgeschichte der Amphibien, Fische, . . . etc. Esslingen, 1842. fol. pls.

Anon. 686

Text in German and French. Another ed., Stuttgart & Esslingen, 1855.

— Naturgeschichte der Fische, Amphibien und Insekten für die Jugend. Nürnberg, 1821. pls. 12°.

Anon. 687

— Naturgeschichte des Thierreichs . . . 4. Bd. Die Fische. 1839. 48 pls.

Anon. 688

— A new system of the natural history of quadrupeds, birds, fishes and insects. 3 vols. Edinburgh & London, 1791-92. illust. 4°.

Anon. 689

— Un nouveau poisson en Marne (Calico bass) *La Pisciculture Pratique*, 1899, **5**, no. 11, 198-199.

Anon. 690

— Nya handlingar rörande sillfisket i Bohus-länska skärgården 1. Göteborg, 1874. 74, xxxi p. 8°.

Anon. 691

"Bihang till Göteborgs och Bohusläns Hushållning-sällskaps Quartalskrift." Catalogue British Museum (Natural History).

— On the generation and migration of eels. *Edinb. Journ. Sci.*, 1828, **9**, 328-330.

Anon. 692

— La pêche à la ligne en eau douce. *Magasin Pittoresque*, 1874,

42, 15-16, 47-49, 87-88, 127-128, 159-160, 202-205, 231-232, 263-264, 303-304, 335-336. Anon. 693

— Pêche à la ligne en mer. Magasin Pittoresque, 1876, 44, 271-272, 307-309, 342-344, 366-368, 382-384. figs. Anon. 694

— Poisonous fish. Brit. Med. Journ., 1888, 2, 242-243. Anon. 695

— Le poisson arc-en-ciel et son nid. Magasin Pittoresque, 1876, 44, 139. Anon. 696

— Poissons de l'Inde; l'ambassade ranga ou poisson transparent; l'anabas, ou poisson grimpeur. Magasin Pittoresque, 1876, 44, 276-277. Anon. 697

— Poissons et crustacés des eaux douces et saumâtres de la Belgique et poissons étrangers y introduits. Administration Eaux & Forêts, Bruxelles, [c. 1892]. figs. 6 pls. Anon. 698

— *Salmo salar ouananiche* McC. Naturaliste Canadien, 1914, 41, 20-24. Anon. 699

— Sardine fishery. Journ. Soc. Arts, 1882, 30, 398. Anon. 700

— Super flumina: angling observations of a coarse fisherman. London, 1905. 231 p. 8°. Anon. 701

Contains notes on habits of some English fishes.

— Synoptische Uebersicht der Fische (Pisces). Nach Cuvier's Classi-

fication. Zoolog. Charte No. 5. Weimar, 1837. pls. fol. Anon. 702

— Het visschen van Kakap in de Djoewanarivier. Ind. Gids, 1894, 16. Jahrg., 2, 1115. Anon. 703

— Vom electrischen Aale. Hannöv. Magaz., 1778. 87. Anon. 704

— Von dem Laichen der Fische. Hannöv. Magaz., 1767, 49. Anon. 705

— Von dem so genanten Fiek (*Fasciola intestinalis*) in Fischen. Hannöv. Magaz., 1769, 665. Anon. 706

— Von der Fischerei in Kamerun. Fischerbote, 1913, 5. Jahrg., 313-. Anon. 707

— Warum die Eingeweide der Lachse beständig leer sind. Magazin Anglois, 1765, no. 8. Anon. 708

— Wie Fische lebendig versenden werden. Hannöv. Magaz., 1766. 685. Anon. 709

— De zalmvisscherij van Aberdeen. Tijdschr. Vereen. Nederl. Zee-wezen, 1905, 4. jaarg., 348-349. Anon. 710

— De zeevischvangst in Oost-Indie. Tijdschr. Vereen. Nederl. Zee-wezen, 1905, 4. jaarg., 337-341. Anon. 711

— Zeevisscherijen langs de kusten der eilanden van Nederlandsch-Indie. Tijdschr. Nijverheid. Landb. Ned.-Indie, 1882. Anon. 712

B. ADDENDA

A

Abbott, Charles Compton. The color-sense in fishes. *Science*, 1884, **4**, 336-339. Add. 1884.1

— Note on breeding-habits of the bill-fish (*Tylosurus longirostris*). *Science*, 1888, **12**, 72. Add. 1888.1

Abel, Othenio. Palæontologie und Palæozoologie (In Hinneberg, P. (editor). *Die Kultur der Gegenwart*, Berlin & Leipzig, 1914, Teil 3, p. 303-395) Add. 1914.1

Abernethy, A. S. Salmon in the Clackamas river. *Bull. U. S. Fish Comm.* 1886, **6**, 332. Add. 1886.1

Abildaard, Petrus Christian. Beskrivelse af en nye igle funden paa a giellerne af støren [Description of a new leech found on the gills of sturgeon] *Skrifter Naturh. Selsk., Kjöbenh.*, 1794, **3**, 55-56. Add. 1794.1

Acharius, Erik. Anmärkningar vid Ant. Martin's rön, rörande en besynnerlig mask hos norsken. *K. Vetensk. Acad. Nya Handl.*, 1780, 49. Add. 1780.1

On a worm parasitic on *Osmerus*.

— Anmerkung über Ant. Martin's Nachricht von einem sonderbaren Wurme im Stink. (*Osmerus*). *König. Schwed. Akad., Neue Abhandl.*, 1780, 47. Add. 1780.2

See note under Kästner, A. G., in Pre-Linn. section.

Acloque, A. Les provertébrés. *Cosmos*, Paris, 1913, n. s. **69**, 569-571. 5 figs. Add. 1913.1

Adams, Arthur. Notes on the natural history of the islands [of the East Indies] (In Sir Edward Belcher's *Narrative of the voyage of H. M. S. "Samarang" during the years 1843-1846, etc.* 2 vols. London, 1848) Add. 1848.1

Vol. II, Colors of fishes, 232. Habits of fishes, 258-259; 306. Singing of *Pogonias*, 259. Voracity of sharks, 296. Poisoning fish, 327; 350; 428. Fishing with floats, 428.

Adams, Charles C. Guide to the study of animal ecology. New York, 1913. xii, 183 p. illust. Add. 1913.1

For numerous references to fishes, see his index.

Adams, C. R. A text-book of commercial geography. New York, 1901. Add. 1901.1

Considerable data on fisheries.

Adams, Emma H. Salmon canning in Oregon. *Bull. U. S. Fish Comm.* 1885, **5**, 365. Add. 1885.1

Adams, Joseph. Ten thousand miles through Canada. The natural resources, commercial industries, fish and game, sports and pastimes of the great Dominion. London, [n. d.]. 50 ills. map. 12°.

Adamson, W. A. The decrease, restoration and preservation of salmon in Canada. *Canadian Journ.*, 1857, n. s. **2**, 1-7. Add. 1857.1

Adanson, Michael [1727-1806] *Cours d'histoire naturelle fait en 1772.* 4 vols. Paris, 1844-45. 18°. Add. 1844.1

Vol. II, p. 170, Trygon; orthotype *Raja pastinaca* L., a synonym of *Dasyatis* Raf.

Addinsell, A. W. On a case of poisoning by sardines. *Lancet*, 1884, **2**, 540. Add. 1884.1

Aflalo, Frederick George. Sunshine and sport in Florida and the West Indies. Philadelphia, 1907. Add. 1907.1

— Sunset playgrounds: fishing days and others in California and Florida. London, 1909. 251 p. illust. Add. 1909.1

— An idler in the near east. London, 1910. 279 p. illust. Add. 1910.1

Fish & fishing in Egypt, Palestine, and the Sea of Marmora.

— A fisherman's summer in Canada. London, 1911. 160 p. illust. 4°. Add. 1911.1

Agassiz, [John] Louis [Rodolphe] [1807–1873] For biographical and memorial notices, and estimates of his work as a naturalist, see Vol. I. Blanc, H. 1907.1; Blanchard, C. E. 1865.1; Eastman, C. R. 1898.1; Goeldi, E. A. 1894.1; Jordan, D. S. 1898.1. Vol. II. Morse, E. S. 1907.1; Studer, T. 1908.1; Wilder, B. G. 1907.2. See also Lyman, T. Commemorative notice of Louis Agassiz. Proc. Amer. Acad. Sci., Boston, 1874, 9. 13 p. 8°.

— Rapport sur les poissons fossiles découverts en Angleterre. Neuchâtel, 1835. 72 p. 8°. Add. 1835.1

Reprinted from the "Recherches sur les poissons fossiles." 4. livr., 4, 33–52, note.

— On the structure of the scales of fishes. Micros. Journ. Struct. Rec., 1841, 1, 122–124. Add. 1841.1

See also Agassiz, J. L. R. 1840.2 in Vol. I.

— [Fossil fishes] (In Duff, P. Sketch of the geology of Moray. Elgin, 1842. 72 p. 10 pls. map.) Add. 1842.1

Describes *Diplacanthus*, p. 71; orthotype *D. crassissimus* = *D. striatus* Ag. Name here misspelled *Diplocanthus*.

— Notice sur les poissons fossiles et l'ostéologie du genre Brochet (*Esox*). Neuchâtel, 1842. pls. map. 4°. Add. 1842.2

— Lettres sur les poissons fossiles du système Dévonien de la Russie (In Murchison, R. I., Verneuil, E. de & Keyserling, A. de. Géologie de la Russie d'Europe et des Montagnes de l'Oural. London & Paris, 1845, vol. II.) Add. 1845.1

— Twelve lectures on comparative embryology, delivered before the Lowell Institute, in Boston, . . . 1848–49, &c. Boston, 1849. 104 p. illust. 4°. Add. 1849.1

— On a viviparous fish from Japan. Proc. Amer. Acad. Arts Sci., 1855, 3, 204. Add. 1855.1

— An essay on classification. London, 1859. viii, 381 p. 8°. Add. 1859.1

See also this author in Vol. I, 1857.2 & 1858.1.

— The structure of animal life. Six lectures delivered . . . in . . . 1862. London, 1866. viii, 128 p. illust. 8°. Add. 1866.1

Agassiz, A. & Garman, S. Fishes and reptiles (In Garman, S. Exploration

of Lake Titicaca) Bull. Mus. Comp. Zool. Harv. Coll., 1875, 3, no. 11.

Add. 1875.1

Aharoni, J. Die Tierwelt des Jordantals und Toten Meer-Gebiets (In Blanckenhorn, Max. Naturwissenschaftliche Studien am Toten Meer und in Jordantal. Berlin, 1912.)

Add. 1912.1

Fische, p. 434–435.

Ahlborn, F. Ueber die Bedeutung der Zirbeldrüse. Zeitschr. Wiss. Zool., 1884, 40, 331–337. Add. 1884.1

Aignan, — & Guillard, — Notions élémentaires sur la mer, la navigation et la pêche. (n. p.) 1898. 222 p. 29 figs. map. Add. 1898.1

Albers, Johann Abraham. Beobachtungen über das Auge des Kabeljau's (*Gadus*) Götting. Gelehrt. Anz., 1806. Add. 1806.1

— Bemerkungen über den Bau der Augen verschiedener Thiere. Denkschr. Acad. Wiss. München, 1808, 81–90. pl. Add. 1808.1

Eye of *Gadus* and *Coryphæna* described and figured.

Albert I, Honoré Charles (Prince de Monaco) Apuntes acerca de los aparatos de pesca empleados á bordo de la Hirondele por S. A. S. el Principe de Monaco, por D. I. Bolivar. (Lista de las publicaciones hechas con los materiales y les observaciones procedentes de las campañas del yacht Hirondele) Soc. Españ. Hist. Nat. Anales, Madrid, 1891, 22. 8°. Add. 1891.1

— Sur les premières campagnes scientifiques de la "Princesse Alice." C. R. Acad. Sci. Paris, 1895, 120, 20–24. Add. 1895.1

Albert-Petit, — & others. La pêche moderne. Encyclopédie du pêcheur. Paris, 1901. 680 figs. 8°. Add. 1901.1

Albertis, L. M. d'. New Guinea: what I did and what I saw. 2 vols. 2nd edition. London, 1881. 830 p. illust. Add. 1881.1

Numerous references in both volumes, but no fishes named. Vol. I, fishing with nets, p. 273, with dynamite, p. 330. Vol. II, indefinite reference to unnamed catfish taken in Fly river; oral gestation in a catfish, p. 189.

Alcock, A. W. On the bathybial fishes of the Arabian sea obtained during the season 1889–90. Ann. Mag. Nat. Hist., 1890, 295–311. Add. 1890.1

Alessandri, Giulio de. Sopra alcuni fossili aquitaniani dei dintorni di Acqui. Boll. Soc. Geol. Ital., 1900, 19. anno, 549-554. Add. 1900.1

Alexander, —. Ueber Fischvergiftung mit Vorstellung von Kranken. 65. Jahresber. Schles. Ges. Breslau, 1887 (1888), 42-49. — Breslau. Aerztl. Zeitschr., 1888, 10, 25-28. Add. 1888.1

Alexander, J. E. Notes of two expeditions up the Essequibo and Mazarony rivers in 1830 and 1831. Journ. Roy. Geogr. Soc., 1832, 32, 67. Add. 1832.1

Notes on oral gestation for several unnamed catfishes of Guiana.

Alexander, M. L. The paddle-fish (*Polyodon spathula*) Trans. Amer. Fisheries Soc., 1914, 73-78. Add. 1914.1

Alexander, W. B. On a specimen of *Regalecus glesne* Ascan. obtained in Australia. Rec. W. Austral. Mus., Perth, 1914, 1, 236-240. Add. 1914.1

Alexandrov, K. Der Fischfang im Wolgabassin oberhalb von Saratov. 1. Liefg. (Text in Russian) St. Petersburg, 1909. 98 p. illust. 8°. Add. 1909.1

Alghetti, Giro. Curiosità di storia naturale. Milano, 1914. 437 p. 644 ill. Add. 1914.1

Fishes, p. 141-175. 89 figs.

Allard, G. Du poisson considéré comme aliment dans les temps anciens et modernes et de ses effets sur l'organisme humain. 1853. 96 p. 4°. Add. 1853.1

Allary, J. Les bateaux de pêche à moteur à Arcachon. Bull. Trim. Enseign. Pêches Maritimes, Paris, 1913, 18, 244-251. pl. 4 figs. Add. 1913.1

Allen, Grant. Fish as fathers. Cornhill Magaz., 1890, n. s. 15, 164-176. — Littell's Living Age, 1890, 71, 262-269. — Science in Arcady, London, 1892. 157-176. Add. 1890.1

Breeding habits and parental care of fishes.

Allen, Harrison. On the pectoral filaments in the sea robin (*Prionotus* [*Prionotus*] *palmipes*). Proc. Acad. Nat. Sci. Philad., 1885, 377. Add. 1885.1

Allen, Joel Asaph. Preliminary list of works and papers relating to the mam-

malian orders of Cete and Sirenia. Bull. U. S. Geol. Survey, 1882, 6, no. 3, 399-562. Add. 1882.1

Contains references to early natural history works dealing with fish and fishing.

Alquen, F. L. d'. Vollständiges Handbuch der feineren Angelkunst. Leipzig, 1862. pl. & 122 figs. 8°. Add. 1862.1

Ambrose, J. Some account of the petrel, the sea-serpent and the albacore, as observed at St. Margaret's bay. Proc. Trans. Nova Scotia Inst. Nat. Sci., 1864, 1, pt. 2, 34-44. Add. 1864.1

Amerinzew, S. Ueber Myxosporidien aus der Gallenblase der Fische. Zool. Anz., 1907, 21, 831-834. Add. 1907.1

— Studien über parasitische Protozoen. VII. Ueber Sporenbildung bei Myxidium sp. aus der Gallenblase von *Cottus scorpius*. Arch. Protistenkunde, 1911, 23, 199-204. Add. 1911.1

Amico, F. C. de. Osservazioni pratiche intorno la pesca, il corso, il cammino dei tonni. Messina, 1816. Add. 1816.1

Amundsen, Roald. The northwest passage; being the record of a voyage of exploration of the ship "Gjøa" in 1903 by Roald Amundsen, with a supplement by First Lieutenant Hansen, etc. 2 vols. New York, 1908. illust. Add. 1908.1

Numerous references to fish and fishing in vol. ii.

Anchieta, José d'. For biography, see Vol. I. Bocage, J. V. du, 1897.1.

Anderson, A. Y. Bacteriological investigation as to the cause of an outbreak of disease among the fish at the marine laboratory, Bay of Nigg. 28. Ann. Rept. Fishery Board. Scotland, part 3. Aberdeen, 1911. Add. 1911.1

Anderson, John. Dura Den. A monograph of the yellow sandstone and its remarkable fossil remains. Edinburgh, 1859. 96 p. illust. 8°. Add. 1859.1

— Notes upon the Scotch fish and fisheries. Bull. U. S. Fish Comm. 1885, 5, 217-221. Add. 1885.1

André, Eugène. A naturalist in the Guianas. London, 1904. 310 p. illust. Add. 1904.1

Modes of fishing, p. 75; 97; 135-136; 182-183; 205.

Andres, Ad. Ueber Frei- und Gefangenleben einiger Nilfische. *Barbus stigmatopygus* Blgr. und *Barbus anema* Blgr. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 423-424. fig.

Add. 1914.1

Andrews, E. A. An Amphioxus from Japan. Do Butsu Gaku Zasshi, 1895, 7, 102-106.

Add. 1895.1

See also Andrews, E. A. 1895.1.

Andrews, William. On the sea fisheries of Ireland [abstract] Edinburgh New. Phil. Journ., 1857, 6, 336-337.

Add. 1857.1

— On the cod and ling fisheries of Ireland. Dublin Quart. Journ. Sci. 1861, 1, 382-396. — Journ. Roy. Dublin Soc. 1860-62 (1862), 3, 224-239.

Add. 1862.1

Anet, Claude. The Manafi-i-Heiwan, I. Burlington Magazine, 1913, 23, no. 124. illust.

Add. 1913.1

Description of a 13th century Persian MS. bestiary preserved in the private library of John Pierpont Morgan in New York. A number of fishes are included among the admirably drawn animal figures.

Anguita i Stüven, V. La siguatera. Union Méd. Sant. Chile, 1897, 4, 345-349.

Add. 1897.1

Ankarcrone, Theodore. *Blennius sinensis* descriptus. Analect. Transalp., Venice, 1762, 1, 103-105.

Add. 1762.1

See also Ankarkrona, T. Pre-Linn., 1740.2.

Annan, E. Ueber die Chondriosomen der Gonocyten bei Knochenfischen. Anat. Anz., 1913, 44, 449-459. 5 figs.

Add. 1913.1

Annandale, Nelson. Fishes (In Illustrations of the zoology of the royal Indian marine survey ship "Investigator," under the command of Commander T. H. Heming and Capt. W. G. Beauchamp, part 9, plates 39-43. Calcutta, 1901-08)

Add. 1901.1

Annaniassen, A. [Extracts from the report of his voyage to Iceland. From "Selskabet for de Norske Fiskeriers Fremme".] Rept. U. S. Fish Comm. 1884 (1886), 12, 309-322.

Add. 1886.1

Annin (junior), James. Poachers or destructive visitors to fish ponds. Bull. U. S. Fish Comm. 1884, 4, 85-86.

Add. 1884.1

Anrep, V. K. Poisoning by fish and fish poison [Text in Russian] Vrach,

St. Petersburg, 1885, 6, 213-216. — Sborn. Rabot. Proizved. Lab. Anrepa, Kharkov, 1885-86, 1, 87-100. — Arch. Slaves Biol., Paris, 1886, 1, 341-355.

Add. 1885.1

Antipa, G. Legea pescultural si rezulatele es le dat. Buscar., 1899. 46 p. pls.

Add. 1899.1

Aragon, George. Les côtes d'Islande et la pêche de la morue. Rev. Deux Mondes, 1875, 45. année, 744-779.

Add. 1875.1

Archer, Walter E. Natural history notes on salmon in Norway. 11. Ann. Rept. Fish. Board Scotland, 1893, pt. 2, 55-71.

Add. 1893.1

— [Reports on Scottish salmon fisheries]. 11. Ann. Rept. Fish. Board Scotland, 1893, pt. 2, 5-20. — 12. Rept., 1894, pt. 2, 5-20. — 13. Rept., 1895, pt. 2, 5-15. — 14. Rept., 1896, pt. 2, 5-31. — 15. Rept., 1897, pt. 2, 1-11. — 16. Rept., 1898, pt. 2, 35-71.

Add. 1893.2

— Salmon disease on the Tweed. 11. Ann. Rept. Fish. Board Scotland, 1893, pt. 2, 72-105.

Add. 1893.3

Arenander, Isaac M. (respond.) Orasken til Cumå Kronolax- och sikfiskets förminskning, som ock de hjälpe-medel, som deremot kunna vidtagas. Inaug. Dissert., Åbo, 1771. 15 p. 4°. Reprint in Tidskr. Fiskerinär. Aquikult. (Malmgren), 1869, 36-37.

Add. 1869.1

Carl Robert Giers, præses. 1771.1.

Arenberg, Pierre d'. Acclimatation du black-bass en France. Bull. Soc. Acclim. Paris, 1911, 58, 533-535.

Add. 1911.1

Aresu, Mario. L'ipofisi in *Chimæra monstrosa* L. Anat. Anz., 1914, 47, 181-192. 4 figs.

Add. 1914.1

"Sacco appiattito sulla cui parete dorsale si attacca posteriormente lobo cromofobo e sulla ventrale anteriormente lobo cromofilo."

Ariola, Vincenzo. Di alcuni trematodi di pesci marini. Boll. Mus. Zool. Anat. Comp. Univ. Genova, 1899. 10 p. 5 pl.

Add. 1899.1

— Osservazione sopra alcuni dibotrii dei pesci. Atti Soc. Ligust. Sci. Nat. Geog., Genova, 1899, 10, 60-70; 160-167.

Add. 1899.2

— Nota sul cestodi del *Centrolophus pompilius*. Mon. Zool. Ital., Supp. Firenze, 1900, 11, 14-15.

Add. 1900.1

Armistead, J. J. Atmospheric and other influences on the migration of fishes. Trans. Journ. Proc. Dumfriessh. Galloway Nat. Hist. Antiq. Soc., 1888, 5, 30-37. Add. 1888.1

— The balance of nature in regard to our fisheries. Trans. Journ. Proc. Dumfriessh. Galloway Nat. Hist. Soc., 1890, 6, 216-218. Add. 1890.1

— An anglers' paradise and how to obtain it. London, 1895. 304 p. illust. Add. 1895.1

Contains material on pond culture, and trout culture.

Armistead, Wilson H. Trout waters; management and angling. London, 1908. 203 p. Add. 1908.1

Review in Nature, 1908, 79, 5.

Armour, Andrew [Exhibition of fish remains from Cambuslang] Trans. Geol. Soc. Glasgow, 1867, 2, 29. Add. 1867.1

Armstrong, James. A general catalogue of the fossils [of the west of Scotland] and their mode of occurrence, etc. Trans. Geol. Soc. Glasgow, 1871, 3 (appendix), 66-77. Add. 1871.1

Armstrong, J. O. Maskinongé or Maskenozha. Forest & Stream, 1904, 62, 298. Add. 1904.1

Arnold, I. Influence of naphtha on fish [Text in Russian] Izviest. St. Petersb. Biol. Lab., 1897-98, 2, no. 1, 6-32. Add. 1897.1

Arnold (junior), Isaac ("Gringo", pseudon.) How do blackbass spawn? Forest & Stream, 1881, 16, 113. Add. 1881.1

Arnold, Joh. Paul. *Amblypharyngodon microlepis*. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 443-444. fig. Add. 1914.1

— *Cichlosoma bimaculatum*. Ein alter Bekannter mit neuem Namen im neuen Kleide. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 629-630. fig. Add. 1914.2

— *Cyprinodon calaritanus* Cuv. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 679-680. fig. Add. 1914.3

— *Fundulus guentheri* Pfeffer. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 213-214. 2 figs. Add. 1914.4

— Die Gattung *Ctenops* McClelland. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 149-151. 4 figs. Add. 1914.5

— Die Gattung *Macropodus* Lacép. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 377-380. 4 figs. Add. 1914.6

— *Gobius lyricus* Gir. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 255-259. fig. Add. 1914.7

— *Haplochilus celebensis* Web. und seine Zucht im Zimmeraquarium. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 553-555. 2 figs. Add. 1914.8

— *Mollienisia latipinna* Lesueur. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 1-2. fig. Add. 1914.9

— *Mollienisia velifera* Regan. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 198-199. 2 figs. Add. 1914.10

— *Otocinclus arnoldi* Regan. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 297-299. 2 figs. Add. 1914.11

— *Pelmatochromis annectens* Blgr. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 417. fig. Add. 1914.12

— *Selene vomer* L. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 687-688. 4 figs. Add. 1914.13

— *Tilapia tholloni* Sauvage. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 733-734. fig. Add. 1914.14

— Ueber zwei neue Arten der Gattung *Apistogramma*. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 695-696; 704-705. 2 figs. Add. 1914.15

— Unsere lebendgebärenden Zahnkarpfen. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 58-60. Add. 1914.16

— Weiteres über *Pterophyllum scalare*. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 41-43. 2 figs. Add. 1914.17

— *Xiphorhamphus jenynsii* Gthr. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 170-172. fig. Add. 1914.18

— Zur Namenänderung der lebend-
gebärenden Zahnkarpfen. Wochenschr.
Aquar.-Terrar. Kunde, 1914, 11. Jahrg.
46 figs. Add. 1914.19

Continued under the following sub-titles:

- i. Die Gattung *Xiphophorus* Heckel, etc.
p. 125-126. 3 figs.
- ii. Die Gattungen *Platyphacelus* und *Poecilia*. p. 235-236. 5 figs.
- iii. Die Gattungen *Belonesox*, *Priapichthys*,
Pseudoxiphophorus, *Heterandria* und *Poeciliopsis*. p. 332-334. 5 figs.
- iv. Die Gattung *Mollienisia* Le Sueur 1821.
p. 397-399. 11 figs.
- v. Die Gattung *Limia* Poey 1855. p. 453-
456. 9 figs.
- vi. Die Gattungen *Phallopterychus*, *Phallo-*
ceros und *Cnesterodon*. p. 533-537. 4 figs.
- vii. Die Gattungen *Alfaro* und *Tomeurus*.
p. 589-590. 2 figs.
- viii. Die Gattung *Gambusia* Poey 1855. I.
Teil. p. 795-796. 5 figs.
- ix. Die Gattung *Gambusia* und die Gattung
Heterophalus Regan. p. 819-820. 2 figs.

Arnot, — Shower of herrings in
Kinross-shire [Quoted by R. Jameson]
Edinburgh New Phil. Journ., 1826, 1,
187. Add. 1826.1

Arnoux, E. Examen de l'état de
maturité sexuelle de quelques poissons
du golfe de Marseille. Ann. Mus. Hist.
Nat. Marseille (Zool.), 1889, 3, 95-99.
Add. 1889.1

— Examen de la pâtre de quel-
ques poissons comestibles du golfe de
Marseille. Ann. Mus. Hist. Nat. Mar-
seille (Zool.), 1889, 3, 87-95.
Add. 1889.2

Artaud, J. B. L. Notice pour servir
à l'histoire naturelle du Goramy ou
Gourami. Ann. Maritimes, 1827, 2,
50-58. Add. 1827.1

Ovarian gestation noted.

Artigalas, —, **Layet, A.**, &
Ferré, G. See **Layet, A.**, **Artiga-**
las, —, & **Ferré**.

Arvelin, J. E. Rymättylän silakka
ja sen maine. Suomen Kalastus Lehti,
1893, 2, 99-100. — Fiskeritidskr. Fin-
land, 2, 100-101. Add. 1893.1

Clupea sprattus (*ausbovis*) at Rymotyla and
its name (?) (use).

— Silakkakalain pyynti suvella
Rymättylän pitäjässä ja sen lähiseudu-
illa. Suomen Kalastus Lehti, 1893, 2,
97-98. — Fiskeritidskr. Finland, 2, 97-
99. Add. 1893.2

Clupea sprattus fishing during the summer at
Rymotyla village and its environs.

— Silakkakalain pyynnistä Luon-
nonmaan saarella. Suomen Kalastus
Lehti, 1894, 3, 109-110. — Fiskeritidskr.
Finland, 3, 109-111. Add. 1894.1

Clupea sprattus at Luononmaa Island.

Asher, Adolf. Bibliographical essay
on the collection of voyages and travels
edited and published by Levinus Hul-
sius and his successors, at Nuremberg
and Frankfort from anno 1598 to 1660.
Berlin, 1839. 118 p. Add. 1839.1

Assmann, P. Beitrag zur Kenntnis
der Stratigraphie des oberschlesischen
Muschelkalks. Jahrb. Preuss. Geol.
Landesanst., 1913, 34, pt. 1, 268-340.
pl. Add. 1913.1

Atella, E., & **Brunelli, G.** See **Bru-**
nelli & Atella.

Atkins, Charles G. On fishways.
Rept. U. S. Fish Comm. 1872-73, 591-
616. Add. 1873.1

— Salmon spawn. 7. Ann. Rept.
Comm. Inland Fisheries Massachusetts,
1873, 25-28. Add. 1873.2

— Memoranda relative to inclo-
sures for the confinement of salmon,
drawn from experience at Bucksport,
Penobscot river, Maine. Bull. U. S.
Fish Comm., 1884, 4, 170-174.
Add. 1884.1

— Report on the propagation of
Penobscot salmon in 1881, 1882. Re-
port U. S. Fish Comm. 1881 (1884) 9,
1085-1090. Add. 1884.2

— Report on the propagation of
Schoodic salmon for 1881, 1882. Re-
port U. S. Fish Comm. 1881 (1884), 9,
1091-1106. Add. 1884.3

— Notes on foreign fish-culture
and fisheries. Trans. Amer. Fisheries
Soc. 1910 (1911), 423-438. Add. 1911.1
Several selections from various foreign
fishery journals.

— The Atlantic salmon. Trans.
Amer. Fisheries Soc. 1913 (1914), 173-
178. Add. 1914.1

Atkins, C. G., & **Boardman, S. L.**
See **Boardman & Atkins**.

Atkins, Charles G., & **others.** A
manual of fish-culture, based on the
methods of the United States Commis-
sion of Fish and Fisheries. Rept. U. S.
Fish. Comm. 1898, 23, 340 p.
Add. 1898.1

Atwater, Wilbur Olin. On the chem-
istry of fish. Proc. Amer. Assoc. Ad-
vanc. Sci., 1884, 170. Add. 1884.1

— Analysis of a sample of fish
guano made from salmon offal; by Mr.

Atwater, W. O.

Joseph Spratt, of Victoria, British Columbia. Bull. U. S. Fish Comm. 1884, 4, 238. Add. 1884.2

— Tables illustrative of the nutritive value of fish. Bull. U. S. Fish Comm. 1884, 4, 203-205. Add. 1884.3

— The chemical composition and nutritive value of food-fishes and aquatic invertebrates. Report U. S. Fish Comm. 1888 (1892), 16, 679-868. Add. 1892.1

Atwood, Nathaniel E. [Notes on the habits of some marine fishes] Proc. Boston Soc. Nat. Hist. 1856-59 (1859), 6, 175-176. Add. 1859.1

— Fisheries of the coast of Massachusetts. 5. Ann. Rept. Comm. Inland Fisheries Massachusetts, 1871, 63-74. Add. 1871.1

— On the possible exhaustion of sea fisheries. 5. Ann. Rept. Comm. Inland Fisheries Massachusetts, 1871, 60-63. Add. 1871.2

— Fisheries on the coast of Massachusetts. Rept. U. S. Fish Comm. 1871-72 (1873), 1, 117. Add. 1873.1

— Unexplained variations in the yield of oil from cod livers. Bull. U. S. Fish Comm. 1883, 3, 431-432. Add. 1883.1

Aubert, H. Die Bewegungsempfindung. Arch. Gesammt. Physiol., Bonn, 1886, 39. Add. 1886.1

Aubriet, Cl. Deux suites de papillons, d'oiseux et de poissons. (In Lambert, — Bibliothèque de physique. 5 vols. Paris, 1758. 12°) Add. 1758.1

— Recueil de coquillages et de poissons. (In Lambert, — Bibliothèque de physique. 5 vols. Paris, 1758. 12°.) Add. 1758.2

Aubry, O. *Acara portalegrensis* Reg. und seine Zucht. Wochenschr. Aquar.-

Terrar. Kunde, 1914, 11. Jahrg., 727-730. fig. Add. 1914.1

Audeville, André d'. Nos poissons d'eau douce. Bull. Piscicult. Prat., Paris, 1888. Add. 1888.1

Auerbach, M. Ein Myxobolus im Kopfe von *Gadus aeglefinus*. Zool. Anz., 1906, 30, 568-570. 4 figs. Add. 1906.1

— Bemerkungen über Myxosporidien heimischer Süßwasserfische. Zool. Anz., 1907, 32, 456-465. 7 figs. Add. 1907.1

Lota vulgaris and *Tinca vulgaris*.

— Ein neuer Myxobolus in Brachsen (*Abramis brama* L.) Zool. Anz., 1907, 31, 386-391. Add. 1907.2

— Weitere Mitteilungen über *Myxobolus aeglefini* Auerbach. Zool. Anz., 1907, 31, 115-119. Add. 1907.3

— Studien über die Myxosporidien der norwegischen Seefische und ihre Verbreitung. Zool. Jahrb., Syst. Abth., 1912, 34, 1-50. 5 pls. 5 text-figs. Add. 1912.1

Augur, C. H. Fish nets: some account of their construction and the application of the various forms to American fisheries. Bull. U. S. Fish Comm. 1893 (1894), 13, 381-388. Add. 1894.1

Austin, F. W. G. On some of the fishes of the St. Lawrence. Trans. Lit. Hist. Soc. Quebec, 1866, n. s. 4, 103-120. Add. 1866.1

Autenrieth, H. F. (*præses*) [1799-1874] Dissertatio inauguralis medica de piscibus venenatis, sectio prima . . . quam . . . præside H. F. Autenrieth . . . submittit F. J. Lipp, &c. Tubingæ, 1829. 31 p. 8°. Add. 1829.1
F. J. Lipp, *respond.*

Ayres, H. Some brain landmarks, with a consideration of the neuropore, nose, hypophysis and mouth. The Lancet-Clinic, Dec., 1907, 4 pages, 3 figs. Also separately; Cincinnati, 1907. Add. 1907.1

B

B., C. B. Een apologie van den haai. Tijdschr. Vereen. Nederl. Zeewezen, 1905, 4, 347-348. Add. 1905.1

B., J. Du repeuplement des cours d'eau. La Pisciculture Pratique, 1899, 5, no. 11, 189-192. Add. 1899.1

— La truite du lac de Garde (*Trutta carpio*) La Pisciculture Pratique, 1899, 5, no. 11, 192-193. Add. 1899.2

B., L. Smelts breeding in an aquarium. Ann. Mag. Nat. Hist., 1868, 4, ser. 1, 486. Add. 1868.1

B., Th. v. Beschryving der dieren, en van zeldzaame visschen en gekorvene diertjes. Amsterdam, 1770. 170 p. 10 pls. 8°. Add. 1770.1

Babák, Edward. Die Mechanik und Innervation der Atmung (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, I, Hälfte 2, p. 265-918. 169 figs. Jena, 1912-14). Add. 1912.1
Acrania, Cyclostomata und Fische, p. 591-706. 18 figs.

— Ueber die Tätigkeit der Atemzentren bei den Fischen. Internat. Rev. Gesamt. Hydrobiol. & Hydrogr., 1913, 6, 69-72. Add. 1913.1

Babbitt, A. C. Michigan grayling (*Thymallus tricolor*) Trans. Amer. Fisheries Soc., 1900, 106-108. Add. 1900.1

Babcock, John Pease. Report of the fisheries commissioner for British Columbia for the year 1902. Victoria, B. C., 1903. 38 p. pls., maps, & charts. Add. 1903.1

— Report of the fisheries commissioner for British Columbia for the year 1903. Victoria, B. C., 1904. 15 p. 8 pls. Add. 1904.1

— Some experiments in the burial of salmon eggs — suggesting a new method of hatching salmon and trout. Trans. Amer. Fisheries Soc. 1910 (1911), 393-396. Add. 1911.1

Bachiller y Morales, Antonio. Cuba primitiva: origin, lenguas, tradiciones

e historia de las Indios de los Antilles Mayores y los Lucayos. 2d. ed. Habana, 1883. Add. 1883.1

Native names of fishes. Fishing with Guianan or remora.

Bachmann, Freda M. The migration of the germ cells in *Amiurus nebulosus*. Biol. Bull. Woods Hole, 1914, 26, 351-363. 2 pls. Add. 1914.1

Backman, E. L. Om det hypotoniska mediet inverkan på Selachiernas syrgasandning (Ueber die Bedeutung des hypotonischen Mediums für die Sauerstoffatmung der Selachier) Läkaref. Förh. Upsala, 1914, n. s. 20, 94-122. Add. 1914.1

Résumé in German, p. 113-122.

Baer, K. E. von. For biographical sketch see Stieda, L., K. E. von Baer. Eine biographische Skizze. Braunschweig, 1878. xii, 301 p. port. 8°.

— Ueber die Kiemen und Kiemengefäße in den Embryonen der Wirbeltiere. Arch. Anat. Physiol. (Meckel), 1827, 556-568. Add. 1827.1

— Ueber das Gefäß-System des Brautfisches. Nov. Act. Acad. Nat. Cur., Vratislaviae & Bonnæ, 1835, 17, 393-408. pl. Add. 1835.1

— Ueber doppelreihigen Missgeburten. Mem. Acad. Sci. St. Pétersb., 1845, 6. ser. 4, pt. 2, 79. Add. 1845.1

Baglioni, S. Alcune esperienze di fisiologia dei sensi negli animali marini (olfatto e senso tattile). Atti Soc. Ital. Progr. Sci., 1909, 2, 399. Add. 1909.1

"Balistes. Eliminazione del senso visivo. Sensi olfattorio e tattile squisiti."

— Physiologie des Nervensystems (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. IV, Hälfte 1, p. 23-450. 57 figs. Jena, 1910-11) Add. 1910.1

Fische, p. 336-352. fig.

— Die niederen Sinne (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. IV, p. 520-554. Jena, 1912) Add. 1912.1

Seitenorgane der Fische, p. 530-537. Geschmackssinn der Fische, p. 549-552.

Baikie, Edwin Simpson. The international dictionary for naturalists and sportsmen, in English, French, and German, containing the terms used in . . . natural history and the sciences. London, Paris, & Strassburg, [1878-79]. 284 p. 8°. Add. 1878.1

Baikie, William Balfour. Note on the Rev. G. Gordon's list of Moray fishes. *Zoologist*, 1852, **10**, 3599. Add. 1852.1

— Some account of the zoological Museum at Haslar Hospital [Gosport, England] *Zoologist*, 1852, **10**, 3613-3615. Add. 1852.2

— Catalogue of the fishes of Orkney and Zetland. *Zoologist*, 1853, **11**, 3845-3847; 3950-3952; 4018-4020. Add. 1853.1

Baily, William Hellier. Figures of characteristic British fossils, with descriptive remarks. Part 1, Cambrian and Lower Silurian; part 2, Lower and Upper Silurian; part 3, Upper Silurian and Devonian; part 4, Devonian, Old Red Sandstone, Carboniferous and Permian, 1867-75. 42 pls. 8°. Add. 1867.1

This is Vol. I, complete (all published).

— Notice of some additional labyrinthodont amphibia and fish from the coal of Yarrow colliery, near Castlecomer, County of Kilkenny, Ireland. *Rept. Brit. Assoc. Adv. Sci.*, 48. meet., 1878 (1879), 530. Add. 1878.1

Baird, Spencer F. Memoranda of inquiry relative to the food fishes of the United States. *Smithson. Misc. Colls.*, 1871, **10**. Add. 1871.1

— Fish and their food. 8. *Ann. Rept. Comm. Inland Fisheries, Massachusetts*, 1874, 42-45. Add. 1874.1

— Note on Dr. Suckley's article on the North American species of salmon and trout. *Rept. U. S. Fish Comm.* 1872-73 (1874), **2**, 91. Add. 1874.2

— Address on fish-culture. *Trans. Amer. Fish-culturists' Assoc.*, 1876-77 (1877), 64-69. Add. 1877.1

— Reports of the Commissioner for 1883, 1884, 1885, 1886. *Rept. U. S. Fish Comm.* 1883 (1885), **11**, xvii-xcv. — *Ibid.*, 1884 (1886), **12**, xiii-lxxi. — *Ibid.*, 1885 (1887), **13**, xix-cxii. — *Ibid.*, 1886 (1889), **14**, ix-lvii. Add. 1883.3

— On the specimens received by the Smithsonian Institution from the United

States life-saving service. [*Pseudotriacis microdon* from Amagansett, N. Y.] *Bull. U. S. Fish Comm.* 1884, **4**, 177-178. Add. 1884.1

— The sea fisheries of eastern North America. *Rept. U. S. Fish Comm.* 1886 (1889), **14**, 3-224. Add. 1889.1

Baird, S. F., & Gill, T. N. See Gill & Baird.

Baird, S. F., & Girard, C. Descriptions of some new fishes from the river Zuni. *Proc. Acad. Nat. Sci. Philad.* 1853 (1854), **6**, 368-369. Add. 1854.1
Gila, new genus.

Baird, William. Note on the occurrence of *Filaria sanguinaria* in the body of *Galaxias scribea*, a fresh water fish from Australia. *Proc. Zool. Soc. London*, 1861, 207-208. Add. 1861.1

Bajon, — De Raia torpedine et Gymnoto electrico. *Obs. Phys. (Rozier)*, 1772, 176. Add. 1772.1

Baker, (Sir) Samuel White [1821-1893] Exploration of the Nile tributaries of Abyssinia. Hartford, 1868. 608 p. illust. Add. 1868.1

Silurids and other fishes in the Atbara and Blue Nile rivers.

Baker, Thomas R. A rain of fishes. *Science*, 1893, **21**, 335. Add. 1893.1

Baker, W. (Fishes of Somersetshire) (In his *The Somersetshire fauna*. *Proc., Somerset. Archaeol. Soc.*, 1849-50, **1**, 140-148. *Ibid.*, **2**, 97-110; 116-122.) Add. 1849.1

Balbani, G. Les sporozoaires. *Journ. Microg.*, 1883, **7**. Add. 1883.1

x. Myxosporidies ou Psorospermies des poissons, 143-147.

xi & xii. Les myxosporidies [des poissons] 197-204; 270-281.

Balfour, Henry. Kite-fishing (In *Essays and studies presented to William Ridgeway on his sixtieth birthday* — edited by E. C. Quiggin. p. 583-608. 20 figs. Cambridge, 1913) Add. 1913.1

Ball, James Dyer. Things Chinese: being notes on various subjects connected with China. 3rd ed. (revised and enlarged) London, 1900. Add. 1900.1

Various notes on fishes; fishing with the cormorant, p. 147-149; with the otter, p. 663.

— The same. 4th ed. London, 1904. Add. 1904.1

Ballot, —. Notice sur deux carpes monstrueuses pêchées dans les étangs. Mém. Soc. Roy. Sci. Orléans, 1837, 1, 212 & 220. 2 pls. Add. 1837.1

Ballowitz, Emil. Die Nervenendigungen der Pigmentzellen, ein Beitrag zur Kenntnis des Zusammenhanges der Endverzweigungen der Nerven mit dem Protoplasma der Zellen. Zeitschr. Wiss. Zool., 1893, 56, 673-706. 5 pls. Add. 1893.1

Ten teleosts studied.

— Ueber das Vorkommen echter peripherer Nervendnetze [von Torpedo]. Anat. Anz., 1894, 9, 165-169. pl. Add. 1894.1

— Ueber die Pigmentströmung in den Farbstoffzellen und die Kanälchenstruktur des Chromatophoren-Protoplasmas. Arch. Gesammt. Physiol., 1914, 157, 165-210. 4 pls. & 6 figs. Add. 1914.1

Hirnhaut von Gobius.

— Vier Momentaufnahmen der intracellulären Pigmentströmungen in den Chromatophoren erwachsener Knochenfische. Arch. Zellforsch., 1914, 12, 553-557. pl. Add. 1914.2

— Zur Kenntnis des feineren Baues des Chromatophoren-Protoplasmas. Arch. Zellforsch., 1914, 12, 558-566. 2 pls. Add. 1914.3

Banfield, E. J. My tropic isle. London, 1911. 315 p. illust. 8°. Add. 1911.1

Much first-hand data about the fishes of the barrier reef of Australia.

— The confessions of a beach-comber. Scenes and incidents in the career of an unprofessional beach-comber in tropical Queensland. London, 1913. 336 pp. 47 pls. Add. 1913.1

Fishes, p. 137-157; fishing with Remora p. 239-246; with poisons, p. 269.

Bang, Hofman. Om de fiskearter, som findes ved kysterne af det nordlige Fynen og i Odense Fiord. Tidskr. Naturv., 1823, 2, 357-379. Add. 1823.1

Baraldi, Giovanni. L'osso sfenotico dei pesci teleostei (Parker) nell' *Ovis aries*, L. Atti Soc. Tosc. Sci. Nat. Pisa, 1883-85, (*Proc.-verb.*), 4, 251-252. Add. 1883.1

Barbolani di Montauto, G. *L'Histophorus herschelii* (Gray) nel terziario

superiore. Palæontographia Italica, 1910, 16, 1-22. 2 pls. Add. 1910.1

Barfurth, Dietrich. Die Erscheinungen der Regeneration bei Wirbeltiereimbryonen. 1903. (In Hertwig, O. Handbuch Entwicklungslehre der Wirbeltiere, 1906. vol. iii, pt. 3) Add. 1903.1

This monograph appeared in 1903. Fishes, p. 48-49; 74-78. 5 figs.

Barker, E. L. The incipieny of the menhaden oil business. Bull. U. S. Fish Comm., 1883, 3, 456. Add. 1883.1

Barlow, A. E. Report on the fish of the Nipissing and Temiscaming region, Ontario. Rept. Geol. Surv. Canada, 1899, 10. Add. 1899.1

Barnes, Ernest W. The season of 1910 at the Fisheries Experiment Station at Wickford, R. I. Trans. Amer. Fisheries Soc. 1910 (1911), 365-370. Add. 1911.1

Barreswil, — Sur le blanc d'ablette (*Alburnus lucidus*) qui sert à la fabrication des perles fausses. C. R. Acad. Sci. Paris, 1861, 53, 246. Add. 1861.1

Earliest demonstration of guanin in integument of fishes.

Barrett, John (director) A reference list of bibliographies [relating to Latin America] (In List of Latin American history and description in the Columbus Memorial Library, with supplements nos. 1 and 2. Washington, 1907-1914. Supplement no. 2, 1914. p. 123-132) Add. 1914.1

Barrows, Walter Bradford. Flight of the flying-fish. Science, 1883, 1, 603. Add. 1883.1

Bartet, — & Raveret-Wattel, — See Raveret-Wattel & Bartet.

Barthélemy-Saint-Hilaire, Jules. Traités des parties des animaux, et de la marche des animaux d'Aristote, traduits en Français . . . et accompagnés de notes perpétuelles par J. Barthélemy-Saint-Hilaire. 2 vols (in 1). Paris, 1885. 8°. Add. 1885.1

— Traité de la génération des animaux d'Aristote traduit en Français . . . et accompagné de notes perpétuelles par J. Barthélemy-Saint-Hilaire. 2 vols. Paris, 1887. 8°. Add. 1887.1

Bartlett, S. P. Rescue work — the saving of fish from overflowed lands.

Bartlett, S. C.

Trans. Amer. Fisheries Soc. 1910 (1911), 153-158. Add. 1911.1

Baskett, J. N. Story of the fishes. New York, 1899. 297 p. 117 figs. Add. 1899.1

Bassani, Francesco [1853-1916] For biography see Vol. II. Lorenzo, G. de. 1916.1. For biography and list of his works see D'Erasmo, G. Francesco Bassani: Commemorazione. Coll. Soc. Geol. Ital., 1916, 35, xlix-lxxvi. portr.

— Sopra un pesce fossile degli scisti calcareo-marnosi triassici del Galletto presso Laveno sul lago Maggiore (*Peltopleurus humilis* Kner). Boll. Com. Geol. Ital., 1914, 5. ser. 4, 101-105. pl. Add. 1914.1

— Sopra un *Pholidophorus* del Trias superiore del Tinetto nel golfo della Spezia. Rendic. Accad. Lincei, Roma, 1914, 5. ser. 23, 2. sem., 379-383. fig. Add. 1914.2

Bassett, F. S. Sea phantoms. (n. p.) 1892. Add. 1892.1

Chap. v. Sea monsters, p. 203, with extensive bibliography in foot-notes.

Bassett-Smith, Percy William. A list of the parasitic Copepoda of fish obtained at Plymouth. Journ. Mar. Biol. Assoc., 1895-97, 4, 155-163. Add. 1895.1

— Further new parasitic copepods found on fish in the Indo-tropical region. Ann. Mag. Nat. Hist., 1898, 7. ser. 2, 77-98. 4 pls. Add. 1898.1

— Some new or rare parasitic copepods found on fish in the Indo-tropic region. Ann. Mag. Nat. Hist., 1898, 7. ser. 2, 357-372. Add. 1898.2

Bassompierre, —, & Schneider, —. Envenimation par la piqure de la vive; accidents d'intoxication sur-aiguë; traitement par le sérum anti-venimeux. Arch. Méd. Pharm. Mil., Paris, 1899, 34, 301-306. Add. 1899.1

Bastedo, S. T. The stocking of inland waters with black bass. Forest & Stream, 1903, 60, 130-131. Add. 1903.1

Bastien, J. F. La nouvelle maison rustique, édition entièrement refondue, etc., 3 vols. Paris, 1798-1804. 60 pls. 4°. Add. 1798.1

"The latest form of the work first published by Estienne, Charles, in 1565, and afterwards by

Liger, Louis, in 1700, of both of which many editions were issued. It includes 'La pêche.'" — Westwood & Satchell.

Batchelor, John. The Ainu of Japan, etc. London, 1892. Add. 1892.1
Spearing salmon and swordfish, fishing with nets and traps, p. 152-157. figs.

Bates, W. H. Fishes' eyes. Bull. N. Y. Zool. Soc., 1914, 17, 1170-1173. 7 figs. Add. 1914.1

Bateson, W. Sense of touch in the rockling (*Motella*) Journ. Mar. Biol. Assoc., 1889-90, n. s. 1, 214. Add. 1890.1

Battara, Giovanni Antonio. Rerum naturalium historia, nempe quadrupedum, insectorum, piscium, variorumque marinarum corporum, fossilium, plantarum ac praesertim testaceorum existentium in Museo Kircheriano, edita iam a Phil. Bonanno, nunc vero nova methodo distributa, notis illustrata, in tabulis reformata, nouisque obseruatt. locupletata a Joh. Anton Batarra. 2 vols. Rome, 1773-82. Add. 1773.1

See also Buonanni, F., in Pre-Linn. section.

— Epistola selectas de re naturali observationes complectens. Arimini, 1774. 25 p. pls. 4°. Add. 1774.1

— Epistola de pene rajarum contre Kleinium. Actis Sienensibus, [1774?] 4, 313. Abstract in Com. de Rebus, 19, 639. Add. 1774.2

Baudelot, —. Analyse et traduction d'un mémoire d'Owjanikow sur le système nerveux de l'*Amphioxus lanceolatus*. Bull. Soc. Nat. Strasbourg, 1869, 2. ann., 16. Add. 1869.1

Bauer, Johann Jacob (compiler). Bibliotheca librorum rariorum universalis, oder vollständiges Verzeichniss rarer Bücher, aus den besten Schriftstellern. 4 vols. & 2 suppl. vols. Nürnberg, 1770-1774. Add. 1770.1

Vol. i, 1770; vols. ii & iii, 1771; vol. iv, 1772; suppl. vols. i & ii, 1774.

Bauer, Victor. Zur Hypothese der physikalischen Wärmeregulierung durch Chromatophoren. Zeitschr. Allgem. Physiol., 1914, 16, 191-212. fig. Add. 1914.1

Contains only incidental reference to fishes.

Baum, H., Henkel, Fr., & Stansch, K. See Henkel, Baum, & Stansch.

Bauricius, L. G. N. Harengboekjes Tijdsch. Vereen. Nederl. Zeewezen, 1905, jaarg. 4, 230-232; 373. 3 figs. Add. 1905.1

Bean, Barton A. Notes on a collection of fishes from Mexico, with description of a new species of *Platypharodon*. [*P. quitzeoensis*] Proc. U. S. Nat. Mus., 1898 (1899), **21**, 539-542.
Add. 1899.1

— Fishes of the Bahama Islands. (In Shattuck, George B. (editor). The Bahama Islands. New York, 1905, p. 293-325.)
Add. 1905.1

Correct citation for Bean, B. A. 1905.1.

Bean, Tarleton H. A contribution to the biography of the commercial cod of Alaska. Trans. Amer. Fish-cult. Assoc., 1881, 16-34.
Add. 1881.1

— Notes on a shipment by the United States Fish Commission, of California salmon (*Oncorhynchus chouicha*) to Tanners creek, Indiana, in 1876. Bull. U. S. Fish Comm. 1881, **1**, 204.
Add. 1881.2

— Account of a shipment by the United States Fish Commission of California salmon-fry (*Oncorhynchus chouicha*) to southern Louisiana, with a note on some collections made at Tickfaw. Bull. U. S. Fish Comm. 1881 (1882), **1**, 205-206.
Add. 1882.1

— The deep-sea fish, *Malacosteus*. Science, 1884, **3**, 747.
Add. 1884.1

— List of the fishes distributed by the United States Fish Commission. Rept. U. S. Fish Comm. 1882 (1884), **10**, 1039-1044.
Add. 1884.2

— (translator) Use of light in sea-fishing. Bull. U. S. Fish Comm. 1884, **4**, 387-389.
Add. 1884.3

Translation of an anonymous article in the Norsk Fiskeritidende, 1884, **3**, no. 2, 114-116.

— Report of the department of fishes of the U. S. National Museum. Rept. U. S. Nat. Mus., 1883 (1885), 68-79.
Add. 1885.1

— On salmon caught in Lake Alexandra, 81° 40' N. (In Greely, A. W. Three years of Arctic service, etc. 2 vols. London, 1886. Vol. II, Appendix, xii. illust. 8°)
Add. 1886.1

— Report of the department of fishes of the U. S. National Museum. Rept. U. S. Nat. Mus., 1885 (1886), 95-98.
Add. 1886.2

— Hybrids in Salmonidæ. Trans. Amer. Fisheries Soc., 1889, 12-20.
Add. 1889.1

— Notes on [the fishes taken on] the cruise of the "Grampus" on the southern mackerel grounds during the spring fishery of 1887. Bull. U. S. Fish Comm. 1887 (1889), **7**, 241-258.
Add. 1889.2

— Report of the department of fishes of the U. S. National Museum. Rept. U. S. Nat. Mus., 1887 (1889), 105-110.
Add. 1889.3

— Report of the department of fishes of the U. S. National Museum. Rept. U. S. Nat. Mus., 1888 (1890), 155-158.
Add. 1890.1

— Report of the department of fishes of the U. S. National Museum. Rept. U. S. Nat. Mus., 1889 (1891), 369-370.
Add. 1891.1

— Report of the department of fishes of the U. S. National Museum. Rept. U. S. Nat. Mus., 1891 (1892), 219-221.
Add. 1892.1

— Report of the department of fishes of the U. S. National Museum. Rept. U. S. Nat. Mus., 1892 (1893), 159-161.
Add. 1893.1

— Report of the representative of the United States Fish Commission at the World's Columbian Exposition. Rept. U. S. Fish. Comm. 1894 (1896), **20**, 177-196.
Add. 1896.1

— Report on the propagation and distribution of food-fishes. Rept. U. S. Fish Comm. 1894 (1896), **20**, 20-80.
Add. 1896.2

— The work of the United States Fish Commission. Trans. Amer. Fisheries Soc. 1895 (1896), 75-82.
Add. 1896.3

— Fish and game department of the Universal Exposition of St. Louis. Trans. Amer. Fisheries Soc., 1904, 55-59.
Add. 1904.1

— The muskalonge of the Ohio basin. Trans. Amer. Fisheries Soc., 1908, 145-151.
Add. 1908.1

— Report of the state fish culturist. Ann. Rept. Forest, Fish & Game Comm. N. Y., 1907-09 (1910), 308-357.
Add. 1910.1

— Report of the state fish culturist. 16. Ann. Rept. Forest, Fish & Game Comm. N. Y., 1911, 137-142.
Add. 1911.1

Beard, J. On the development of the common skate (*Raja batis*). 8. Ann. Rept. Fishery Board Scotland, 1892, 300-311. 3 pls. Add. 1892.1

— On a supposed law of metazoan development. Anat. Anz., 1893, 8, 22-29. Add. 1893.1

Larval forms of fishes considered.

— The numerical law of the germ cells. Anat. Anz., 1902, 21, 189-200. Add. 1902.1

Studies on eggs of fishes.

Beaufort, Lieven Ferdinand de. Die Anatomie und systematische Stellung des genus *Kurtus* Bloch. Morph. Jahrb., Leipzig, 1914, 48, 391-410. pl. Add. 1914.1

— Skeletten van *Kurtus indicus* en *K. gulliveri*. Tijdschr. Nederl. Dierk. Vereen., 1914, 2. ser. 13, i-iii. Add. 1914.2

Beaugrand, C. L'aquarium du Havre. 1884. 103 p. 20 pls. Add. 1884.1

Beauregard, Henri. Les poissons électriques. Lum. Elect., 1884, 13, 201-207, 251-257, 334-338, 372-375. Add. 1884.1

— Note sur le Protoptère (*Protopterus annectens*) C. R. Mem. Soc. Biol., Paris, 1889, 41, 556-558. Add. 1889.1

— Le canal carotidien des roussettes. C. R. Mem. Soc. Biol. Paris, 1892, 44, 914-916. Add. 1892.1

Beccari, Odoardo. Wanderings in the great forests of Borneo: travels and researches of a naturalist in Sarawak. [1865-1868]. London, 1904. 424 p. illust. Add. 1904.1

Habits *Toxotes jaculator*, 139-141. Oral gestation in a siluroid, 160. Colored siluroids in forest streams, 181. Dyak names of fishes, 237, 239-240. Poisonous fish, 239. Talking fish, 240, 293. Sharks in forest water, 304, 313-315. Fishing with hooks, 175; with "Tuba" (Derris), 240.

Becke, Louis. Wild life in southern seas. London, 1897, 369 p. Add. 1897.1

Trolling for bonito with pearl shellhooks. p. 37. Sharks. p. 68-78. Deep sea fishing, p. 112-127. The *palu* or purgative fish, 119.

— By rock and pool on an austral shore. New York, 1901. 250 p. 8°. Add. 1901.1

Much interesting data on habits of fishes and on modes of fishing in the South Seas.

— Notes from my south sea log. London, 1905. 352 pp. Add. 1905.1
Valuable data about sharks and other fishes.

— Neath austral skies. London, 1909. Add. 1909.1

Method of fishing for *Ruvettus*, the purgative fish. Habits of sharks and other fishes.

Becker, Karl. Der dreistachliche Stichling (*Gasterosteus aculeatus* L.). Seine Zucht und Pflege im Zimmer Aquarium. Wochenschr. Aquar.-Terrar. Kunde, Braunschweig, 1907, 4, no. 38. Add. 1907.1

Beckley, (Mrs.) Emma Metcalf. Hawaiian fishing implements and methods of fishing [abstract] Bull. Bur. Fisheries, 1886 (1887), 6, 245-256. Add. 1887.1

See also Beckley, 1883.1

Beebe, Mary Blair & Beebe, C. William. Our search for a wilderness. New York, 1910. Add. 1910.1

The crucifix in the catfish skull, p. 13, fig. 5. Habits of Anableps.

Beeson, Charles H., & Eigenmann, Carl H. See **Eigenmann & Beeson**.

Behr, S. von. Address made at the meeting of the German Fishery Association, at Berlin, March 16, 1877, by Herr von Behr, of Schmoldov, president of the association, member of the German Parliament. Rept. U. S. Fish Comm. 1875-76 (1878), 4, 1014-1024. Add. 1878.1

See also Behr, S. 1877.1.

Beintker, E. Die ältesten Urkunden der Anklamer Fischerinnung. Monatsblätter Ges. Pommersche Gesch. Altertumskunde, 1912, no. 4, 49-61. Add. 1912.1

Belding, Dana L. The inland waters of Massachusetts. How the Massachusetts department of fisheries and game is stocking inland waters with the fishes best adapted to the environment. Science Conspectus, 1914, 4, 71-74. Add. 1914.1

Belin, J. Note sur un cas d'intoxication par des œufs de harengs. France Méd., Paris, 1886, 2, 1458-1460. — Bull. Soc. Clin. Paris, 1886 (1887), 10, 124-126. Add. 1886.1

Bell, Francis Jaffry. Description of a new species of *Tristomum* from *Histiophorus brevirostris*. Ann. Mag. Nat. Hist., 1891, 6. ser. 7, 534-545. Add. 1891.1

Bell (junior), Robert. On the natural history of the gulf of St. Lawrence, and the distribution of the mollusca of eastern Canada. *Canadian Natural. & Geol.*, 1859, **4**, 197-220. Add. 1859.1

— Report on an exploration of the east coast of Hudson's bay, in 1877. *Rept. Geol. Surv. Canada*, 1877-78 (1879), **5**, 1-37C. Add. 1879.1

— Recent explorations to the south of Hudson's bay. *Geogr. Journ.*, 1897, **10**, 1-19. Add. 1897.1

Fishes, p. 16; nest-building habits of *Semotilus corporalis*, p. 16.

Bell, W. A. The Joggins Carboniferous section. (Nova Scotia) (In Excursion in eastern Quebec and the Maritime Provinces. *Canada Dept. of Mines, Geol. Survey, Ottawa*, 1913, Guide Book, no. 1, pt. 2, 326-346. pl. map) Add. 1913.1

Bellecci, A., & Polara, G. Sulla tossicità del siero di sangue di alcune specie di Murenoidi. *Arch. Farm. Sper. Sci. Aff.*, 1907, **6**, 598-622. Add. 1907.1

Serum of *Anguilla vulgaris*, *Muraena halena*, *Conger myrus*, *C. vulgaris* and *Congromuraena balearica*, very poisonous. Serum of *Ophichthys* less so.

Bellesme, Jousset de. De l'emploi des filtres en pisciculture. *La Pisciculture Pratique*, 1899, **5**, no. 10, 169-179. Add. 1899.1

Bellingeri, C. F. Del peso assoluto e relativo dei visceri negli animali vertebrati (Pesci) con deduzioni fisio-patologico. *Torino*, 1849. 162 p. 4°. Add. 1849.1

Bellini, Arturo. Intorno all decapitazione delle anguille. *Neptunia, Venezia*, 1901, **16**, 17-18. Add. 1901.1

Bellotti, Cristoforo. Descrizione de alcune nuove specie di pesci fossili de Perledo e di altre località Lombarde. (In Stoppani, A. *Studii geologici e paleontologici sulla Lombardia*, etc. *Milano*, 1857. xx, 461 p. 3 pls. 1 tab. 8°.) Add. 1857.1

— Note ittiologiche. Osservazione fatte sulla collizioni ittiologica del civico museo di storia naturale, in Milano. *Atti Soc. Ital. Sci. Nat. Milan*, 1883, **26**, 165-181. text-fig. Add. 1883.1

I leptocephali del mare di Messina.

— (I terremoti ed i pesci del Mediterraneo) *Atti Soc. Ital. Sci. Nat., Milan*, 1887, **30**, 351-352. Add. 1887.1

Bénard, C. La pêche à vapeur et le dépeuplement des fonds sous-marins. *Copenhagen*, 1902. 17 p. Add. 1902.1

— L'océanographie, les pêches maritimes et les produits de la mer à l'exposition coloniale de Marseille en 1906; rapport général. *Marseille*, 1907. 528 p. 118 pls. Add. 1907.1

Benecke, Berthold. Die Nutzung des Wassers durch Fischzucht. *Landwirthschaftliche Thierzucht*, 1884, **4**, nos. 119-133. Add. 1884.1

This is translated as follows:

— Utilizing water by fish culture. *Rept. U. S. Fish Comm.* 1883 (1885), 1101-1131. 5 pls. Add. 1885.1

Beneden, Pierre Joseph van. For account of life and works, see Kemna, Ad. *La vie et l'œuvre d'un zoologiste.* Anvers, 1897. 137 p. 8°.

— Les helminthes cestoides, considérés sans le rapport de leurs métamorphoses, de leur composition anatomique et de leur classification et mention de quelques espèces nouvelles de nos poissons plagiostomes. *Bull. Acad. Roy. Sci. Belgique*, 1849, **16**, pt. 2, 269-282. *Ibid.*, 1850, **17**, pt. 1, 102-108. Add. 1849.1

— Note sur un crustacé parasite nouveau, avec l'énumération des espèces de cette classe qu'on observe sur les poissons du littoral de Belgique. *L'Institut*, 1851, **19** (sec. 1), 285-286. Add. 1851.1

Abstract of Beneden, P. J. van, 1851.1

— *Scymnus glacialis*; ses parasites. *L'Institut*, Paris, 1853, **21** (sec. 1), 354. Add. 1853.1

Abstract of Beneden, P. J. van, 1853.4.

— Note sur l'*Octobothrium* du merlan et sur axine de l'orphie. *Bull. Acad. Roy. Sci. Belgique*, 1856, **23**, pt. 2, 643-654. pl. — *L'Institut*, 1857, **25**, 643-644. pl. Add. 1856.1

— Note sur un trématode nouveau du maigre d'Europe. *Bull. Acad. Roy. Sci. Belgique*, 1856, **23**, pt. 2, 502-508. pl. — *L'Institut*, 1857, **25**, 142-143. Add. 1856.2

— Sur les parasites de l'*Orthogoriscus mola*. *L'Institut*, 1856, **24**, 83-84. Add. 1856.3

See also Beneden, P. J. van, 1855.1

- Beneden, P. J. v.**
 — Animal messmates and parasites. New York, 1876. xxviii, 274 p. illust. Add. 1876.1
 Parasitic fish and fish parasites.
- Deux cestodes nouveaux de *Lamna cornubica*. Bull. Acad. Roy. Sci. Belgique, 1889, 3. ser. 17, 68-74. pl. Add. 1889.1
- Un mot sur le squalé pèlerin. Bull. Acad. Roy. Bruxelles, 1893, 26, 33-36. Add. 1893.1
- Benedict, Harris M.** On the structure of two fish tapeworms from the genus *Proteocephalus* Weinland. Centralb. Bakteriolog. Parasitenk. Jena, 1902, 31, Abtheilung 1, 119. Add. 1902.1
 Review of Benedict, H. M., 1900.1.
- Benignus, Siegfried.** In Chile, Patagonien, und auf Feuerland: Ergebnisse mehrjähriger Reisen und Studien. Berlin, 1912. 369 p. Add. 1912.1
 Patagonian fishes, 356-362. fig.
- Bening, —.** Beschreibung des Tobias [fisches] Hannöv. Mag., 1780, 337. Add. 1780.1
- Bennett, George.** Wanderings in New South Wales, Batavia, Pedir Coast, Singapore, and China; being the journal of a naturalist in those countries during 1832, 1833, and 1834. 2 vols. London, 1834. Add. 1834.1
 Fishes, I, p. 17; 29-35; 42; 179-181; 242; 373; 410; 432; II, p. 14, 252, 262-278. Sucking fish, 274-276.
- Bennett, John Hughes.** On the parasitic vegetable structures found growing on living animals. Trans. Roy. Soc. Edinburgh, 1842 (1844), 15, 277-294. pl. Add. 1844.1
 Cryptogamous parasite on gold fish, p. 284-287.
- Bent, Theodore.** Fishing in the Greek islands. Pop. Sci. Monthly, 1889, 35, 861. Add. 1889.1
- Béranger-Féraud, Laurent Jean Baptiste.** Etude d'un empoisonnement multiple survenu à Lorient par l'usage de morue altérée. Arch. Méd. Navale, 1884, 42, 440-456. *Ibid.*, 1885, 43, 5-25. Add. 1884.1
- Recherches sur les accidents que provoque la morue altérée. Ann. Hyg. Publ., Paris, 1885, 14, 331-340, 427-456, 516-549. Add. 1885.1
- Berg, Carlos.** For biographical and bibliographical notices, see Vol. I. Gallardo, A. 1902.1; Vol. II. Schweder, G. 1902.1; Zeballos, E. S. 1897.1.
- Berg, Lew Semenowitch.** Faune de la Russie. Petrograd, 1914. Add. 1914.1
 Poissons, vol. iii, pt. 2, 337-704. 3 pls.
- Notice sur le genre *Aspiopsis* Zugmayer. Ann. Mus. Zool. Acad. Sci., Petrograd, 1914, 19, xxv-xxvi. Add. 1914.2
- Les poissons du fleuve Toumen-Oula (Corée) collectionnés par A. I. Czerski. Ann. Mus. Zool. Acad. Sci., Petrograd, 1914, 19, 554-561. Add. 1914.3
- Berger, E.** Beiträge zur Anatomie und Physiologie von *Luvurus imperialis* Raf. II. Das Auge (In Krukenberg, C. Fr. W. Vergl. Physiol. Studien Adria. Heidelberg, 1881, 1, 4. Abth., 21-28. pl.) Add. 1881.1
- Bergius, Bengt, & Marwitz, —.** von. Auszug zweyer Briefe über die Natur-Geschichte und Verpflanzung des Sterlets. Beschäft. Berlin. Gesell. Naturf. Freunde, 1776, 2, 534-535. *Ibid.*, 4, 91. Add. 1776.1
- Bergman, Arvid M.** Die rote Beulenkrankheit des Aals. Ber. Bayr. Biol. Versuchstat. München, 1909, 2. 2 pls. Add. 1909.1
- Bergmann, Carl, & Leuckart, C. G. F. R.** Anatomisch-physiologische Uebersicht des Thierreichs. Vergleichende Anatomie und Physiologie. Stuttgart, 1855. 690 p. 438 figs. Add. 1855.1
- Berkeley, M. J.** Egg parasites and their relatives. Intell. Obs., 1864, 5, 147-153. pls. Add. 1864.1
 Fungi on fish eggs.
- Bernard, Claude.** Remarques sur l'anatomie comparée du pancréas. C. R. Mém. Soc. Biol., Paris, 1849, 117-119. Add. 1849.1
- Mémoire sur le pancréas, etc. C. R. Acad. Sci. Paris, 1856, Supp. I. 379-563. 9 pls. Add. 1856.1
 Fishes, p. 536-547.
- Leçons sur les phénomènes de la vie communs aux animaux et aux végétaux. 2 vols. 1879. Add. 1879.1
 Glycogen in fishes, II, p. 98. Pancreas of Raia, II, p. 350.
- Bert, Paul.** [1833-1886] Catalogue méthodique des animaux vertébrés qui

vivent à l'état sauvage dans le département de l'Yonne, &c. Paris, 1864. xxii, 129 p. 2 pls. 8°. Add. 1864.1

— Notes diverses sur la locomotion chez plusieurs espèces animales. Mém. Soc. Sci. Bordeaux, 1866, 4, 59. Add. 1866.1

— La mort des animaux d'eau douce que l'on immerge dans l'eau de mer. C. R. Soc. Biol., 1873, 5. ser. 3, 59-61. Add. 1873.1

— Sur la cause de la mort des animaux d'eau qu'on plonge dans l'eau de mer réciproquement. C. R. Acad. Sci. Paris, 1883, 97, 133-136. Add. 1883.1

Berthier, C. La morue rouge. Lyon, 1889. 60 p. Add. 1889.1
A medical thesis.

Berthoule, Amédée. Les migrations sous-marines (sardines). Bull. Soc. Acclim. 1887, 34, 97-110. Add. 1887.1

— Observations relatives à la communication [de M. Egasse sur la grande pêche à la côte occidentale d'Afrique] Bull. Soc. Acclim. France, 1888, 35, 565-568. Add. 1888.1

— Les saumons de Californie (*Salmo quinnat*, *Salmo gairdnerii*) dans le bassin de la Méditerranée. Bull. Soc. Acclim. France, 1889, 36, 274-289. Add. 1889.1

— La truite de l'Oued Zour. Bull. Soc. Acclim. France, 1890, 37, 1182-1189. Add. 1890.1

Bertoni, A. de Winkelried. Fauna Paraguaya. Catálogos sistemáticos de los vertebrados del Paraguay. Peces, batracios, reptiles, aves y mamíferos conocidos hasta 1913. Asunción [1914] 86 p. 8°. Add. 1914.1
Peces, p. 5-15.

Bertram, James G. On the possibility of exhausting the sea fisheries. Rept. U. S. Fish Comm. 1871-72 (1873), 1, 141-144. Add. 1873.1

Bestehorn, Friedrich. Fälschung einer Potsdamer Fischereiurkunde. Arch. Fischereigesch., 1913, Heft 1, 200-203. Add. 1913.1

— Die geschichtliche Entwicklung des märkischen Fischereiwesens, ein Beitrag zur Kultur- und Wirtschaftsgeschichte der Mark Brandenburg. Arch. Fischereigesch., 1913, Heft 1, 1-199. Add. 1913.2

Bettoni, Eugenio. For biography and list of works see Rendic. Inst. Lomb., Milano, 1898, 31, 1285-1299. — Comment. Ateneo Brescia, 1899, 20-23.

— Progetto di stazione di piscicoltura da fondarsi a Brescia. Comment. Ateneo Brescia, 1886, 133-138. Add. 1886.1

— [Della importazione dei Coregoni nei laghi Maggiore e di Como] Comment. Ateneo Brescia, 1894, 49-58. Add. 1894.1

— Casi di emiteria presentati dal luccio. Rendic. Inst. Lomb., Milan, 1895, 28, 1012-1017. Add. 1895.1

Biarno, Einar. De præparatione Gadi sub nomine, Gadus ex Terra Nova & Gadus in rupibus siccatus (Klipfisk), noti. Rit. Pesz Islenzka Laerdoms-Lista Felags., 1782, 3, 1-27. Add. 1782.1

Bickel, Adolf. Beiträge zur Rückenmarksphysiologie des Aales. Arch. Gesamt. Physiol., 1897, 68, 110-119. Add. 1897.1

— Beiträge zur Rückenmarksphysiologie der Fische. Arch. Anat. & Physiol., 1900 (Physiol. Abth.), 481-484. Add. 1900.1

Bicknell, E. P., & Dresslar, F. B. A review of the species of the genus Pimephales. Proc. Acad. Nat. Sci. Philad., 1885, 63. Add. 1885.1

Biedermann, W. Untersuchungen über das Magenepithel. Sitzb. Akad. Wiss. Wien (Math-Natur Klasse), 1875, 71, 377-398, pl. Add. 1875.1

— Elektrophysiologie. 2 vols. Jena, 1895. 857 p. 281 figs. Add. 1895.1

Die elektrischen Fische, p. 748-842. 52 figs. English translation by F. A. Welby, London, 1896.

— Die Aufnahme, Verarbeitung und Assimilation der Nahrung (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. II, Hälfte 1, p. 1-1563. 465 figs. Jena, 1911) Add. 1911.1

Die Ernährung der Fische, 1049-1115. 20 figs. This contains an extensive bibliography.

Bierbaum, Georg. Untersuchungen über den Bau der Gehörorgane von Tiefseefischen. Zeitschr. Wiss. Zool., 1914, 111, 281-380. 2 pls. & 17 figs. Add. 1914.1

Biese, Franz. Die Philosophie des Aristoteles, in ihrem inneren Zusammenhang . . . aus dessen Schriften entwickelt. 2 vols. Berlin, 1835-42. 8°. Add. 1835.1

Biétreix, E., & Fabre-Domergue, P. See **Fabre-Domergue & Biétreix.**

Bigelow, Henry B. Explorations in the gulf of Maine, July and August, 1912, by the U. S. Fisheries schooner "Grampus." Oceanography and notes on the plankton. Bull. Mus. Comp. Zool. Harvard Coll., 1914, **58**, no. 2, 31-147. 9 pls. Add. 1914.1
List of fishes begins at p. 107.

Biot, J. B. Ueber die Natur der in der Schwimmblase enthaltenen Luft. Journ. Chemie. Physik. Mineral. (Gehlen's), 1807, **4**, 582-602. Add. 1807.1

Translation by J. J. Stolz of J. B. Biot, 1807.1.

Birge, E. A., & Juday, C. The inland lakes of Wisconsin; the dissolved gases of the water and their biological significance. Madison [Wis.] 1911. 259 p. illust. 4°. Bull. U. S. Fish Comm. 1912 (1914), **32**, 525-610. 6 pls. & 23 text-figs. Add. 1911.1

Biró, Ludwig. Beschreibender Catalog der ethnographischen Sammlung Ludwig Biró's aus Deutsch-Neu-Guinea (Astrolabe-Bai). Budapest, 1901. Add. 1901.1

Fishing apparatus (poison, nets, spears, etc., 66-71).

— Daten zur Schiffart und Fischerei der Bismarck-Insulaner. Anz. Ethn. Abth. Nat. Mus., 1905, **4**. Jahrg., 57-73. 26 figs. Add. 1905.1

Fishing with nets, traps, poisons.

Bischoff, T. W. L. von. Ueber den Bau der Magenschleimhaut. Arch. Anat. Physiol. (Müller), 1838, 503-525. Add. 1838.1

— Description anatomique du *Lepidosiren paradoxa*. Ann. Sci. Nat. (Zool.), 1840, 2 ser., **14**, 118-159. 5 pls. Add. 1840.1

Translation by M. Hubotter of Bischoff, T. W. L., 1840.1

Bischoff, W. Anleitung zur Angelfischerei. 3. Auflage, neu bearbeitet vom Bayerischen Landes-Fischerei-Verein. München, 1908. xvi, 285 p. 5 pls. 183 figs. 8°. Add. 1908.1

See also Bischoff, W., 1864.1

Bishop, W. H. Fish and men in the Maine islands. (Harper's Handy Series), New York, 1885. 129 p. illust. Add. 1885.1

Bissell, J. H. President's address [On fish-culture in the United States] Trans. Amer. Fisheries Soc., 1889, 6-11. Add. 1889.1

Blackford, Eugene G. For memorial notice, see Vol. I., Dean, B., 1905.2.

— American fish foods (In Depew, Chauncey, M. One hundred years of American commerce. 2 vols. New York, 1895. 8°.) Add. 1895.1

Blackford's article covers p. 390-395.

Blagden, C. O., & Skeat, W. W. See **Skeat & Blagden.**

Blair, Emma Helen, & Robertson, James Alexander. The Philippine Islands, 1493-1898. 55 vols. Cleveland [Ohio], 1903-1919. Add. 1903.1

For over 100 references to fishes (native and scientific names given) and fishing, see their excellent index.

Blakey, Robert. Angler's complete guide to the rivers and lakes of England. London, 1859. 184 p. Add. 1859.1
Earlier editions: London, 1853 and 1856.

— The angler's guide to the rivers and lochs of Scotland. London, 1859. illust. 12°. Add. 1859.2
An earlier edition, London, 1854.

— Angling; or, how to angle, and where to go. London, 1862. illust. 16°. Add. 1862.1

Blanc, Henri. Le *Petromyzon pleneri*. Bull. Soc. Vaud., Lausanne, 1890, **25**, xxiii. Add. 1890.1

Blanchard, Emile [1819-1900] For memorial notice see Vol. I. Bouvier, E. L. 1900.1.

— Rapport sur le concours pour le grand prix des sciences physiques de 1862. (Anatomie comparée du système nerveux des poissons) C. R. Acad. Sci. Paris, 1862, **55**, 951-953. Add. 1862.1

— Observations relatives à une communication de M. Carbonnier, sur le mode de respiration de diverses espèces de poissons à pharyngiens labyrinthiformes. C. R. Acad. Sci. Paris, 1874, **78**, 502-503. Add. 1874.1

— Les ouvrages de M. A. Forel sur le lac Léman et les autres lacs de la

Suisse. Journ. Savants, 1896, 171-180; 237-246; 301-309. Add. 1896.1

Blanchard, Raphael. Sur un infusoire péritriche, ectoparasite des poissons d'eau douce. Bull. Soc. Zool. France, Paris, 1885, 10, 277-280. pl. Add. 1885.1

— Expériences sur la marmotte en hibernation. II. Action du sérum d'anguille. C. R. Mém. Soc. Biol., 1903, 55, 736-739. Add. 1903.1

Blanchon, H. L. Alphonse. Du cyprin de la Chine ou poisson rouge, son élevage. La Pisciculture Pratique, 1899, 5, no. 10, 179-184. Add. 1899.1

— La pisciculture amateur. Paris, 1909. 27 p. Add. 1909.1

1. Elevage pratique et lucratif des poissons carnivores; anguille et truite, etc.

2. Elevage pratique des poissons domestiques; carpe et brème.

3. Poissons rouges ou *Cyprin doré*.

— Les races de carpes améliorées. Cosmos, Paris, 1913, n. s. 68, 148-149. Add. 1913.1

Bland-Sutton, (Sir) John. See **Sutton, J. Bland.**

Bleeker, Peter [1819-1878] For biographical notice see Vol. II. Reuter, F. 1914.2.

— Oversigt der te Batavia voorkomende gladschubbige Labroïden, met beschrijving van 11 nieuwe soorten. (Text in French) Moniteur Indes-Orient. Occ., 1849, pt. 1, 41-65; 97-112. Add. 1849.1

A French translation of Bleeker, P. Vol. I, 1849.8.

— *Syngnathus tapeinosoma*, eene nieuwe soort van Solor. Nat. Tijdschr. Nederl. Indie, 1854, 6, 375-376. Add. 1854.1

— Zesde bijdrage tot de kennis der ichthyologische fauna van Celebes. Nat. Tijdschr. Nederl. Indie, 1854, 7, 449-452. Add. 1854.2

— Derde bijdrage tot de kennis der vischfauna van Soembawa. Nat. Tijdschr. Nederl. Indie, 1859, 19, 434-440. Add. 1859.1

— Deuxième notice sur la faune ichthyologique de l'île de Harouko. Nederl. Tijdschr. Dierk., 1866, 3, 41-42. Add. 1866.1

Listed in vol. 1, 1864.4, as a separate.

— Révision des espèces indo-archipélagiques des genres *Plectorhynchus* et *Pristipoma*. Nat. Tijdschr. Dierk., 1873, 4, 273-317. Add. 1873.1

— Poissons de Madagascar et de l'île de la Réunion des collections de MM. Pollen et van Dam. (In Recherches sur la faune de Madagascar et de ses dépendances, d'après les découvertes de François P. L. Pollen et de D. C. van Dam. 4me partie) Leide, 1875. 106 p. 21 pls. Add. 1875.1

Contains a list of all the species of fishes known at that time in the group of islands of which Madagascar is the chief.

Bliss, R. Differences between young and adult fishes. Amer. Naturalist, 1871, 5, 175-176. Add. 1871.1

Bloch, Marcus Elieser [1723-1799] For short biographical notice see Vol. II. Vaillant, L. L. 1903.2.

— Von Ausbrütung der Fische. Hannov. Mag., 1782. pls. — Aller-neust. Mannigfalt., 1, 547. Add. 1782.1

— Nachricht vom Heringsthran. Schrift. Berlin. Naturf. Ges., 1784, 5, 354-373. 2 figs. Add. 1784.1

— Vom Kabeljau. Allerneuesten Mannigfalt., 1784, 3, 145. Add. 1784.2

— Tvä utländska fiskar beskrifne. Vet. Acad. Nya Handl., 1789, 234-236. — Neue Schwed. Akad. Abhandl., 1789, 219. Add. 1789.1

Scorpena plumieri & *S. koenigii*.

Blochmann, Friedrich. Ueber die Fortpflanzung des Aales. Arch. Ver. Freunde Naturgesch. Mecklenburg, 1898, iii-viii. Add. 1898.1

Blyth, Edward. Report of Curator, Zoological department for May, 1858. Journ. Asiat. Soc. Bengal, 1858 (1859), 27. Add. 1859.1

Fishes, p. 270-272; 281-290.

Andamia, p. 270; orthotype *A. expansia*.

Boardman, S. L. & Atkins, C. G. The menhaden and herring fisheries of Maine as sources of fertilization; a report made to the Maine Board of Agriculture. [n. p.] 1876. illust. Add. 1876.1

Boas, J. E. V. Die Schläfenüberdachung und das Palatoquadratum in ihrem Verhältnis zum übrigen Schädel bei den Dipnoern und den terrestren Wirbeltieren. Morphol. Jahrb., 1914, 49, 229-307. 100 figs. Add. 1914.1

Bocage, J. V. Barboza du. [*Centrophorus crepidalbus*]. *Jorn. Acad. Sci. Lisboa*, 1872, **3**. Add. 1872.1

Bock, Fr. Sam. Versuch einer vollständigen Natur und Handlungsgeschichte der Heringe. Königsberg, 1768, 8°. 7 pl. Abstracts in: *Jena Gel. Zeit.*, 1769, 347. — *Alt. Gel. Merc.*, 1769, 300; 401. — *Baldingers Neue Arzneyen*, **2**, 175. — *Allg. Deutsch. Bibl.*, **10**, 2. St., 164. — *Leips. Gel. Zeit.*, 1769, 779. — *Götting. Gel. Anz.*, 1770, 215. *Hannov. Mag.*, 1771, 834. Add. 1768.1

See also Bock, F. S., 1769.1. in vol. I.

Boehmer, George Rudolph. *Bibliotheca scriptorum historiae naturalis, oeconomiae, aliarumque artium ac scientiarum ad illam pertinentium realis systematica*. 2 vols. [in 2 parts each]. *Lipsiae*, 1785–86. 2690 p. 8°. Add. 1785.1

The most extensive bibliography of natural history *ante* Agassiz.

Boeke, J. Rapport betreffende een voorloopig onderzoek naar den toestand van de visscherij en de industrie van zeeproducten in de kolonie Curaçao. 's Gravenhage, 1907. 200 p. 2 pls. 3 figs. 3 maps. 8°. Add. 1907.1

Boëns, Hubert [1825–] Note sur les infusoires ectoparasites des poissons. *Journ. Microg.*, Paris, 1883, **7**, 536–538. Add. 1883.1

Börnstein, — Zur Malariabekämpfung durch moskitolarvenfeindliche Fische im Bismarckarchipel. *Arch. Schiffs-Trop.-Hyg.*, 1914, **18**, 21–26. 4 figs. Add. 1914.1

Boettger, D. (reviewer) Fr. Steindachner's herpetologische und ichthyologische Ergebnisse einer Reise Südamerika. *Zool. Garten*, 1902, **43**, 335–336. Add. 1902.1

Böttger, W. Zur Entstehung der Goldfischlinge. *Blätt. Aquar.-Terrar. Kunde*, 1913, **24**. Jahrg., 53–57, 84–88, 99–101. 2 pls. 12 figs. Add. 1913.1

Bogacev, Vladimir V. La faune des dépôts salifères de la Transcaucasie [Text in Russian] *Ann. Geol. Mineral. Novo-Aleksandrija*, 1913, **15**, 213–222. pl. French résumé, *Ibid.*, 222–227. Add. 1913.1

Describes Tertiary species of Clupeidae.

Bogoliubov, N. N. Étude sur le *Paracymatodus reclinatus* Traut [Text

in Russian] *Ann. Géol. Mineral. Novo-Aleksandrija*, 1914, **16**, 197–199. Add. 1914.1

— Sur l'ichthyodorulithe du *Polyrhizus concavus* Trd. [Carboniferous] de Niatchkovo, gouv. de Moscou [Text in Russian] *Ann. Géol. Mineral. Novo-Aleksandrija*, 1914, **16**, 192–197. Add. 1914.2

Bogolubow, N. N. see **Bogoliubov, N. N.**

Bohn, John. Catalogue of ancient and modern books in all classes of natural history, . . . fishing, etc. London, 1835. 152 p. 8°. Add. 1835.1

Boll, Ernst Friedrich August [1817–1869] For necrology, see Boll, Franz Christian. *Arch. Ver. Freunde Naturgesch. Meklenburg*, 1869, **22**, 1–34.

— Ein Seehund im Schweriner See. *Arch. Ver. Freunde Naturgesch. Meklenburg*, 1854, **8**, 135–136. Add. 1854.1

— [A rain of fishes] *Arch. Ver. Freunde Naturgesch. Meklenburg*, 1858, **12**, 75. Add. 1858.1

— Fischregen im Pommern und Meklenburg. *Arch. Ver. Freunde Naturgesch. Meklenburg*, 1868, **21**, 151–152. Add. 1868.1

To replace Boll, E., 1858.1, error.

Bolton, Herbert. Fish remains from the Lower Coal Measures of Lancashire. *Trans. Geol. Soc. Manchester*, 1890, **20**, 215–222. Add. 1890.1

— Notes on the geological horizon and palæontology of the "Soapstone bed" in the lower Coal-Measures, near Colne, Lancashire. *Geol. Mag.*, 1905, 5. ser. **2**, 433–437. fig. Add. 1905.1

Bonaparte, Charles Lucien. Versuch einer methodischen Vertheilung der Wirbelthiere mit kaltem Blut. *Isis (Oken)*, 1833. Add. 1833.1
Fische, Cols. 1197–1217.

Bondareff, P. G. Poisoning by use of the so-called rolled roe. [Text in Russian] *Vestnik Obsh. Hig.*, Sudeb. Prakt. Med., St. Petersburg, 1898, 2. sect., 325–329. Add. 1898.1

Bondouy, Th. Articles cited under Boudouy, Th., vol. I, p. 159, are correctly by Bondouy, Th.

Bononi, A. La pesca nel Trentino. Eco d. Baldo, Riva, 1913. 8 p. 12°. Add. 1913.1

Bonsdorff, E. J. (*præses*) Disquisitio anatomica, nervum trigeminum partemque cephalicam nervi sympathici *Gadi lotæ*, Linn., cum nervis iisdem apud hominem et mammalia comparans, quam . . . p. p. E. J. Bonsdorff . . . respondente O. A. Toppelius, &c. Helsingforsiae, 1846. 52 p. 1 pl. 4°. Add. 1846.1

O. A. Toppelius, *respond.*

Booth, D. C. Fish-culture possibilities of the national preserves. Trans. Amer. Fisheries Soc. 1910 (1911), 115-118. Add. 1911.1

Borgert, Adolf Hermann Constant. Ein einfaches Netz zum Fischen von Plankton bei schneller Fahrt. Zeitschr. Wiss. Mikr., 1895, 12, 307-311. Add. 1895.1

Borja y Goyeneche, Joaquin de. Necesidad de la oceanografia para las industrias de las pescas. Mem. Real. Acad. Cien. Artes, Barcelona, 1907. 17 p. 4°. Add. 1907.1

Borne, Max von dem [c. 1826-1894] Dry transmission of eggs. Bull. U. S. Fish Comm., 1881 (1882), 1, 345. Add. 1882.1

Translation of Borne, M. v. dem, 1880.6

— Das Wasser für Fischerei und Fischzucht. Neudamm, 1887. 69 p. 4 figs. Add. 1887.1

— Der Schwarzbarsch und der Forellenbarsch (black bass), zwei amerikanische Fische, in Deutschland. Neudamm, 1888. 35 p. figs. Add. 1888.1

— Taschenbuch der Angelfischerei. 5. ed. Berlin, 1914. 13 pls. & 389 text-figs. 8°. Add. 1914.1

See also Borne, M. v. dem, 1904.2

Bose, — Raie (In Nouveau Dictionnaire des Sciences Naturelles, vol. xix, 169-179. Paris, 1803) Add. 1803.1

— Requin (In Nouveau Dictionnaire des Sciences Naturelles, vol. xix, 524, 553. Paris, 1803) Add. 1803.2

Botella y de Hornos, Federigo de [1823-] Descripcion geológica-minera de las provincias de Murcia y Al-

bacete. Madrid, 1868. xxiv, 186 p. 16 pls. 7 maps. ills. Add. 1868.1
Miocene fishes from Lorca, Murcia Prov., Spain.

Bottard, — Note sur la piquêre de la vive. C. R. Soc. Biol. Paris, 1885, 8. sér. 2, 23-26. Add. 1885.1

Bottarel, A. L'appareil à venin des poissons. C. R. Acad. Sci. Paris, 1889, 108, 534-537. Add. 1889.1

Botti, U. Sopra un ittiolito della calcarea tenera leccese. Atti Soc. Ital. Sci. Nat., Milano, 1868, 11, fasc. 3. Add. 1868.1

Boudouy, Th. Articles cited under this author, vol. I, p. 159, are correctly by Bondouy, Th.

Bouffet, — Pisciculture aux laboratoires de Quillan et de Gesse. Bull. Soc. Acclim. France, 1894, 41, 2. sem., 28-31. Add. 1894.1

Bougon, — Les anguilles et leur reproduction. Le Naturaliste, 1899, 21, 2. ser. 13, 200. Add. 1899.1

Bouillot, J. De l'action diurétique et uréopoiétique des alcaloides de l'huile de foie de morue chez l'homme. C. R. Acad. Sci. Paris, 1892, 115, 754-757. Add. 1892.1

— Des alcaloides de l'huile de foie de morue, de leur origine et de leurs effets thérapeutiques. C. R. Acad. Sci., 1893, 116, 439-441, 542. Add. 1893.1

Boulenger, George Albert [1858-] The buccal nursing habits of certain fishes. The Field, Farm, Garden, the Country Gentleman's Magazine, London, 1902, 99, 33. figs. Add. 1902.1

Oral gestation described in several fishes, particularly *Arius sagor* from Malaya; *Tilapia nilotica* and *T. strigigena* from the Nile; and *Apogon nigripinnis* from Maldives and Caroline Islands.

— Catalogue of the fresh-water fishes of Africa in the British Museum (Natural History). 4 vols. London, 1909-1916. 1203 figs. Add. 1909.1

i. Contains the Selachii, Crossopterygii; Dipneusti; Malacopterygii, chiefly Mormyridæ, and Ostariophysi (in part), comprising Characinae and three genera of Cyprinidæ. xi, 373 p. 275 figs. 1909.

ii. Contains Ostariophysi; comprising Cyprinidæ and Siluridæ. xii, 529 p. 382 figs. 1911.

iii. Contains suborders Symbranchii, Apodes, Haplomi, Scombroces (including Cyprinodontidæ), Lophobranchii, and Acanthopterygii (Cichlidæ). xii, 526 p. 351 figs. 1915.

iv. Contains Acanthopterygii; Opisthomi, including Mastacembelidæ; Plectognathi, including Tetraodontidæ. Addenda and general systematic index. xxvii, 392 p. 195 figs. 1916.

Boulenger, G. A.

— Some cases of parental care among fishes. *Country Life*. London, 1909, 907-910. figs. Add. 1909.2

Oral gestation described and figured for various fishes, *Arius falcarius* of Ceylon; *Scleropages osteoglossum formosum* from Sumatra, etc.

— Parental care (oral gestation) in an African fish (*Anabas multispinis*) The Field, the Country Gentleman's Newspaper, 1911, 118, 968. Add. 1911.1

In above species and in *Scleropages osteoglossum*.

— Cichlidæ. *Wissensch. Ergebnisse Deutsch. Zentral Afrika-Exped.* 1907-1908. 5 Zool. 3. 1914, 253-259. Add. 1914.1

— Descriptions of three new fishes from South Cameroon. *Ann. Mag. Nat. Hist.*, 1914, 8. ser. 14, 383-385. Add. 1914.2

Descriptions are given of three new species of *Myomyrus*, *Mormyrus* and *Barilius*.

— Descriptions of two new fishes from Northern Rhodesia. *Ann. Mag. Nat. Hist.*, 1914, 8. ser. 14, 385-386. Add. 1914.3

Two new species are described of *Barbus* and of *Mastacembelus*.

— Diagnoses des poissons nouveaux: I. Acanthopterygiens, Opisthotes, Cyprinodontes (Mission Stappers au Tanganyika-Moero) *Rev. Zool. Afric.*, 1913-14 (1914), 3, 442-447. Add. 1914.4

Boulenger, G. A., & Boulenger, C. L. Animal life by the sea-shore. London, 1914. 83 p. 23 pls. illust. Add. 1914.1

Fishes, p. 1-17.

Bounhiol, Jean Paul. Le régime du thon sur les côtes algériennes et dans la Méditerranée occidentale. *Bull. Trim. Enseign. Prof. Tech. Pêches Marit.*, Paris, 1911, 16, 374-434. Add. 1911.1

Boursse Wils, H. Observationes quædam anatomicæ comparatæ de *Squatina lævi*. *Lugduni Bat.*, 1844. 56 p. pl. 8°. Add. 1844.1

Bouvier-Lapierre, Emile. Observations sur la sardine. *C. R. Mém. Soc. Biol. Paris*, 1887, 8. ser. 4, 795-797. Add. 1887.1

Bowdich, T. Edward. Excursions in Madeira and Porto Santos. London, 1825. Add. 1825.1

Fishes of Madeira, p. 121-125. figs.

Bowdich, (Mrs.) Sarah (Mrs. T. Edward), afterwards Lee, (Mrs.) Sarah. [1791-1856]. Anecdotes of the habits and instincts of birds, reptiles and fishes. London, [1891], iv, 323 p. ills. 8°. Add. 1891.1

Bowdich, (Mrs.) T. Edward. Fishes of the Gambia. (Appendix to Bowdich, T. Edward, Excursions in Madeira and Porto Santos, etc. London, 1825, 233-238. figs.) Add. 1825.1

Bower, Seymour. Fishery conservation. *Trans. Amer. Fisheries Soc.* 1910 (1911), 95-100. Add. 1911.1

Bower, Ward T. History of the American Fisheries Society. *Trans. Amer. Fisheries Soc.* 1910 (1911), 323-358. Add. 1911.1

— Work of the Bureau of Fisheries on the Pacific coast in 1911. *Pacific Fisherman*, Seattle, 1912, 10, 45-46. Add. 1912.1

— The fisheries of Alaska. *Pacific Fisherman*, Seattle, 1914, 12, 7-8. Add. 1914.1

Bower, Ward T., & Chamberlain, Fred. M. See **Chamberlain & Bower.**

Bower, Ward T., & Fassett, Harry C. Fishery industries. (In Alaska fisheries and fur industries in 1913) *Rept. U. S. Comm. Fisheries* 1913 (1914), 37-139. Add. 1914.1

Bowers, G. M. The United States Fisheries Steamer "Albatross" and her work. *Proc. 7. Internat. Zool. Congr.*, Boston, 1907 (1912), 906-909. Add. 1912.1

Bowles, W. [1705-1780] For biography see Colgan, N. 1911.1.

Bowman, Alexander. The distribution of plaice eggs in the northern North sea. *Fisheries Scotland Scient. Invest.*, 1914, no. 2. 67 p. pl. & 5 figs. Add. 1914.1

Bowser, W. J. Report of the fisheries commissioner for British Columbia for the year ending December 31st, 1913. Victoria, B. C., 1914, 7-148 p. 13 figs. 5 pls. maps. Add. 1914.1

Boyce, Robert, & Stephens, J. W. See **Stephens & Boyce.**

Boyd, W. The North American fishery question. *Fortnightly Review*, 1886, 45. Add. 1886.1

- Boyer, Jacques.** Curious exotic fishes. *Scient. Amer.*, 1913, **109**, 92, 99-100. 6 figs. Add. 1913.1
- Le protoptère, curieux poisson aérien. *Cosmos*, Paris, 1913, n. s. **68**, 514-516. 2 figs. Add. 1913.2
- Brackett, Walter M.** *Salmo salar*. 18. Ann. Rept. Comm. Inland Fisheries Massachusetts 1883 (1884), 43-46. Add. 1884.1
- Brady, (Sir) Thomas.** [Observations on the acclimatisation of the true salmon (*Salmo salar*), in Tasmanian waters.] *Proc. Roy. Soc. Tasmania*, 1888, ii-vi, ix-xvi. Add. 1888.1
- Brammertz, Wilhelm.** Ueber das normale Vorkommen von Glykogen in der Retina. [Gefunden bei Hecht]. *Arch. Mikr. Anat.*, 1914, **86**, 1. Abth., 1-7. pl. Add. 1914.1
- Branco, Carl W. F.** Ueber eine neue *Lepidotus*-Art aus dem Wealden. *Jahrb. K. Preuss. Geol. Landesanst. Berlin*, 1884 (1885), 181-200. 2 pls. Add. 1885.1
- Records *L. fittoni* Ag. and *L. degenhardti* n. sp., from Cretaceous at Obernkirchen. See also Branco, C. W., 1885.1.
- Brand, Erdmann.** Die Winterpflege des Scheibenbarsches. *Wochenschr. Aquar.-Terrar. Kunde*, 1914, 11. Jahrg., 711-712. Add. 1914.1
- Brandt, Johann Friedrich, & Ratzeburg, J. T. C.** Hauptresultate aus der Untersuchung über Naturgeschichte der Störarten. *Isis (Oken)*, 1831, **10**, 2002 (1102). Add. 1831.1
- Medizinische Zoologie, oder getreue Darstellung und Beschreibung der Thiere, die in der Arzneimittellehre in Betracht kommen. 2 vols. (in 1) Berlin, 1829-33. 198, 364 p. pls. 4°. Add. 1833.1
- Fishes, Bd. II, p. 1-55; 349-355. 10 pls.
- Brandt, Karl.** Life in the ocean. *Rept. U. S. Nat. Mus.*, 1900, 493-506. Add. 1900.1
- Translation of Brandt, Karl, 1899.1
- Braun, C. F. W.** Ueber *Placodus gigas*, Agassiz, und *P. andriani*, Münster. *Programm, &c. Bayreuth*, 1862. 16 p. 4°. Add. 1862.1
- Braun, Max.** Salm oder Hecht? Eine Erwiderung an Herrn Medicinalrath Dr. Fr. Küchenmeister in Dresden. *Klin. Wochenschr. Berlin*, 1885, **22**, 804-806. Add. 1885.1
- Ueber die Ergebnisse der Untersuchung von sechs Hechten. *Sitzber. Naturf. Gesells. Dorpat*, 1884 (1885), **7**, 45-46. Add. 1885.2
- Mittheilungen über den Nestbau der Stichlinge III. Nestbau und Brutpflege des dreistacheligen Stichlings. *Blätt. Aquar.-Terrar. Freunde*, 1890, **1**, 59. Add. 1890.1
- *Bothriocephalus*-Finnen in Hechten des St. Petersburger Fischmarkts. *St. Petersburg. Med. Wochenschr.*, 1892, **17** (n. F. **9**), 270. — *Zeitschr. Fleisch. Milchhyg.*, Berlin, 1894, **4**, 71. Add. 1892.1
- Helmithologische Notizen. Die Finnen des breiten Bandwurms in Fischen Deutschlands. *Centralb. Bakt. Parasit. Kunde*, Jena, **14**, 802-804. — *Zeitschr. Fleisch. Milchhyg.*, Berlin, 1894, **4**, 71. Add. 1894.1
- Brauner, Joh.** Manière d'attirer le poisson dans le lieu où l'on veut pêcher. *Journ. Oecon.*, 1760, 142. Add. 1760.1
- Breemen, J. P. van.** Bijdrage tot de levensgeschiedenis van de paling (*Anguilla vulgaris* Turt.) *Meded. Visch.*, Helder, 1906, **13**, 161-166; 182-186. Add. 1906.1
- Brett, Alfred Thomas.** On fish-fatality in the river Colne at Watford. *Trans. Herts. Nat. Hist. Soc.*, 1890, **5**, 93-96. Add. 1890.1
- Brian, Alessandro.** Di alcuni crostacei parassiti dei pesci dell' isola d'Elba. *Boll. Mus. Zool.*, Genova, 1899, no. 85, 1-11. Add. 1899.1
- Brice, John J.** [1842-] Establishment of stations for the propagation of salmon on the Pacific coast. *Rept. U. S. Fish Comm.* 1895, **19**, 387-392. Add. 1895.1
- Bridge, T. W.** Vocal organs in fishes. *Midland Naturalist*, 1893, **16**, 168. Add. 1893.1
- Brielman, P.** Fischfang und Jagd der Eingeborenen am Kwango (Kongo-staat). *Globus*, Braunschweig, 1901, **79**, 299-301. 3 figs. Add. 1901.1
- Fishing with poisons (5 kinds) nets and traps.
- Brigidi, Vincenzo, & Tafani, Alessandro.** *Embriologia del Ciprinus au-*

Brigidi & Tafani.

ratus. R. Inst. Stud. Sup. Prat. Perfez. Pubbl., Firenze, 1881, 1. ser. **9**, 115-192. Add. 1881.1

Brind, Walter Lannoy. Domesticated fish; an illustrated textbook of reliable information for amateur and professional aquarists on the identification, care and culture of ornamental domestic and foreign fish. 4 pts. New York, 1914. Add. 1914.1

Title on paper cover reads: Domesticated fish, a textbook on the care and culture of goldfish and exotic fish in home aquaria.

Brix, —, Musset, —, & Ehrenberg. Altona's Fischereihafen und Fischmarkt. Altona, 1896. 3 pls. Add. 1896.1

Brochin, —. Mortalité produite par les émanations putrides s'exhalant d'un dépôt de paniers à poisson. Gazette des Hopitaux, 1860, no. 117, 465. — Ann. Hyg. Pub. & Méd. Lég., 1861, 2. sér. **16**, 222-223. Add. 1860.1

Erroneously attributed by some to E. Beaugrand.

Brodbelt, Francis Rigby. Account of some observations and experiments which he has made on the gas contained in the bladder of the sword-fish. Annals of Medicine (Duncan), 1796, **1**, 393. — Allg. Journ. Chem. Leipzig, 1798, **1**, 2. Hft. Add. 1796.1

— On the elastic fluid contained in the air-vessels of fish. Journ. Nat. Philos., 1797, **1**, 264. Add. 1797.1

Brodie, (Rev.) Peter Bellinger [1815-1897] For biography and list of works see Ent. Month. Mag., 1897, **33**, 283-284. — Geol. Mag., 1897, **4**, 481-485, 576. — Proc. Cotteswold Club, 1896-98, **12**, 201. — Quart. Journ. Geol. Soc., 1898, **54**, lxxvii-lxxii. — Nature, 1897-98, **57**, 31-32. — Proc. Warwick. Field Club, 1900, 46-53.

— On additional remains of cestraciont and other fish in the green marls immediately overlying the red marls of the Upper Keuper in Warwickshire; with an account of the equivalent beds in Germany and the Tyrol. Proc. Warwick. Field Club, 1893, 48-53. Add. 1893.1

Broili, F. Zur Osteologie des Schädels von Placodus. Palæontographica, 1912 (1913), **59**, 147-156. Add. 1913.1

Bronn, Heinrich Georg. Lethæa geognostica, oder Abbildungen und Be-

schreiben der für die Gebirgs-Formation bezeichnendsten Versteinerungen. Third edition. Stuttgart, 1855. Add. 1855.1

See also Bronn, H. G., 1834.1

Brook, George [1857-1893] For biography and works see Amer. Naturalist, 1893, **27**, 917. — Leopoldina, 1893, **29**, 204-205. — Journ. Micr. Soc., 1893, 701. — Nature, 1893, **48**, 420-421. — Proc. Edinb. Phys. Soc., 1894, **12**, 274-276.

— *Callionymus lyra*, the dragonet. 3. Ann. Rept. Fish. Board Scotland, 1885, 68-69. Add. 1885.1

— On the development of the herring. 3. Ann. Rept. Fish. Board Scotland, 1885, 32-51. — 4. Rept., 1886, 31-43. Add. 1885.2

— On some points in the development of pelagic teleostean eggs. Proc. Amer. Assoc. Adv. Sci., 33. meet. 1884 (1885), 533-534. Add. 1885.3

— Preliminary report on the food of the cod. 4. Ann. Rept. Fish. Board Scotland, 1886, 134-147. Add. 1886.1

— Report on the herring fishery of Loch Fyne and the adjacent districts during 1885. 4. Ann. Rept. Fish. Board Scotland, 1886, 47-61. Add. 1886.2

— Notes on the food of young Gadidæ. 5. Ann. Rept. Fish. Board Scotland, 1887, 326-327. Add. 1887.1

— Note on the spawning of the pike. 5. Ann. Rept. Fish. Board Scotland, 1887, 347-349. Add. 1887.2

Brookover, Charles. The development of the olfactory nerve and its associated ganglion in Lepidosteus. Journ. Comp. Neurol., 1914, **24**, 113-130. 17 figs. Abstract in Science, 1914, n. s. **39**, 367-368. Add. 1914.1

Nervus terminalis ganglion cells seem to arise from olfactory placode in a way similar to that described in Amia and Amiurus.

Broun, Allan D. Flying-fish. Nature, 1880-81 (1881), **23**, 509. Add. 1881.1

Broussonet, P. M. August [1761-1807] Ichthyologia sistens piscium descriptiones et icones. London and Vienna, 1782. 24 pls. fol. Add. 1782.1

Rare fishes collected by Jos. Banks. Abstract in Comment. Lips., **25**, 306. — Beckm. Oekon. Physik. Bibl., **14**, 81. — Gött. Gel. Anzeig., 1784.

— Verhandeling over den beefvisch, eene weinig bekende soort van electrieken visch [*Malopterurus*]. Algem. Geneeskund. Jaarboek., 1787, 4, 24-30. Add. 1787.1

Brown, Albert W. Recent researches in the life-history of eels. Proc. Holmesdale Nat. Hist. Club, 1896-98, 54-55. Add. 1896.1

Brown, George. Melanesians and Polynesians; their life histories described and compared. London, 1910. 451 p. illust. Add. 1910.1

Poisonous fish, 134. Fishing customs, 249-250. Fishing with hooks, spears, nets, traps, kites, etc., 322-338. Fishing with poisons (*Tephrosia* and *Barringtonia*), 337.

Brown, John J. The American angler's guide; or, complete fisher's manual for the United States; containing the opinions and practice of the experienced anglers of both hemispheres; with the various modes adopted in ocean, river, lake and pond fishing, etc. New York, 1876. 8°. Add. 1876.1

John Brown's name appears for the first time on the title-page of this edition. Previous editions appearing anonymously are: New York, 1845, 1846, 1849, 1850, 1857 (4th ed. with the addition of a second part).

Brown, (Capt.) Thomas. Anecdotes of the animal kingdom, etc. 2 vols. Edinburgh & London, c. 1869. Add. 1869.1

Fishes, vol. 2, p. 705-793.

— Illustrative anecdotes of birds, fishes and insects. London, [1869] 8°. Add. 1869.2

Bruce, W. S. Zoological results of the Scottish National Antarctic Expedition (1902-1904) [With discussion] 9. Congrès Internat. Zool., Monaco, 1913 (1914), 130-134. Add. 1914.1

Bruch, C. Ueber eigenthümliche Anhänge der Fischwirbel. Zeitschr. Wiss. Zool., 1861-62 (1862), 11, 179-191. pl. Add. 1862.1

— Ueber eigenthümliche Fortsätze der Fischwirbel welche von den Wirbelfortsätzen der höheren Thiere verschieden sind. Zeitschr. Wiss. Zool., 1861-62 (1862), 11, 170-178. Add. 1862.2

Brücke, Ernst. Anatomische Untersuchungen über die sogenannten leuchtenden Augen bei den Wirbeltieren. Arch. Anat. Physiol. Wiss. Med., 1845, 387-405. pl. Add. 1845.1

Tapetum of fishes, p. 402-404.

Brückner, Walter. Haltung und Zucht des Scheibenbarsches (*Mesogonistius chætodon*) Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 746-747. Add. 1914.1

Bruehl, C. Bernhard. Zur Kenntniss des Wirbelthier-Skelettes, &c. Wien, 1845. xvii, xix, 227 p. 3 pls. 12 tab. 4°. Add. 1845.1

"There is a second title which reads: — 'Die Methode des osteologischen Details, dargestellt am Karpfen-Skelette.'" — B. M.

— Anfangsgründe der vergleichenden Anatomie aller Thierklassen. Erster Abschnitt, Die Skelettlehre der Fische, Lief. 1-3. Wien, 1847. iv, 254 p. 19 pls. 4°. & obl. fol. Add. 1847.1

Brüning, Christian. Beitrag zur Kenntniss von *Macrones vittatus*. Blätt. Aquar.-Terrar. Kunde, 1904, 15, 42. Add. 1904.1

— Anabantidæ, Fische, die ertrinken können. Kosmos, Stuttgart, 1914, 11. Jahrg., 295-298. 3 figs. Add. 1914.1

— Aus der Familie der Schmerlen. [Cyprinidæ] Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 739-740. 6 figs. Add. 1914.2

— *Barbus lateristriga* Val. und ein neuer *Xiphophorus* (*X. montezumæ*) Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 469-471. 3 figs. Add. 1914.3

— Darmatmende Welse. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 719-720. fig. Add. 1914.4

— Familiencharakter und Habitus. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 21-24. 8 figs. Add. 1914.5

— Ein flossenloser Anguillide. Ein Beitrag zur Zählebigkeit eines Tropenfisches. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 101-103. 2 figs. Add. 1914.6

— Der japanische Kärpfling. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 313-314. 2 figs. Add. 1914.7

— Eine krallenlose Wasserschildkröte und *Crenicichla spec.* aus dem Amazonenstrom. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 169-170. 3 figs. Add. 1914.8

Brüning, C.

— *Lebiasina bimaculata* C. & V. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 635. fig.

Add. 1914.9

— Meine Grundeln. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 771-773. 4 figs.

Add. 1914.10

— *Mollienisia* und Salzwasser. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 663-664. 2 figs.

Add. 1914.11

— *Mollienisia velifera* Regan. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 334-335.

Add. 1914.12

— Die Muräne. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 591-592. fig.

Add. 1914.13

— Noch einmal *Barbus lateristriga*. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 537-538. 2 figs.

Add. 1914.14

— Notizen über afrikanische Fische. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 126-128; 233-235; 254-255. 7 figs.

Add. 1914.15

— *Rhamdia sebæ* Val. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 360-361. fig.

Add. 1914.16

— *Trichopodus* und *Trichogaster*. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 613-614. 6 figs.

Add. 1914.17

Brünnich, Martin Thrane [1737-1827] *Fundamenta zoologica*. Hafniæ, 1772. 8°.

Add. 1772.1

Structure and classification of fishes dealt with.

Brunelli, G., & Atella, E. *Ricerche sugli adattamenti alla vita planctonica (I Gobidi planctonici)*. Biol. Centralbl., 1914, 34. Jahrg., 458-466. 4 figs.

Add. 1914.1

"Riduzione della mottilità e di conseguenza delle pinne, della muscolatura, dello scheletro, delle otoliti. Decorso rettilineo dell' intestino.

Bruner, Gheorgiĭ. *Bluzhdayushchĭĭ nerv ruib ĭ amfibĭĭ.* [On the vagus nerve in fish & amphibia] Varshava, 1893. 50 p. pl. 8°.

Add. 1893.1

Brunton, J. Of the special senses of fishes, in relation to the art of angling. No. 1, vision. (In Gresham Angling Society. Papers, session 1882-83. London, 1882.)

Add. 1882.1

Bryan, William Alanson. Methods in aquatic photography. Trans. Amer. Fisheries Soc. 1910 (1911), 249-260.

Add. 1911.1

Bryant, E. G. The moon and poisonous fish. Nature, 1912, 90, 305.

Add. 1912.1

Bryce, John J. Report on the fish and fisheries of the coastal waters of Florida. U. S. Senate Miscell. Doc. no. 100, 54. Congr., 2. sess., 1-80. — Rept. U. S. Fish Comm. 1896 (1897), 263-342.

Add. 1897.1

Brydone, Patrick. A tour through Sicily, Malta, etc. London, 1806.

Add. 1806.1

Tunny and swordfish fishing, p. 344-348.

Buch, S. A. Spawning of spring herring near Norway. Bull. U. S. Fish Comm., 1885, 5, 297-300.

Add. 1885.1

Buchwald, — von. Regesten aus den Fischereiurkunden der Mark Brandenburg 1150-1710. Berlin, 1903.

Add. 1903.1

Buck, W. O. Pike-perch notes and suggestions. Trans. Amer. Fisheries Soc. 1910 (1911), 283-288.

Add. 1911.1

— Catch-basin ponds. Trans. Amer. Fisheries Soc., 1914, 67-70.

Add. 1914.1

Buckland, F. Bestandtheile des Fleisches von Lachsen und Heringen im Vergleich zu dem von Rindfleisch. Arch. Pharmac., 1878, 3. ser. 54, 178.

Add. 1878.1

Buckland, F., & Walpole, S. Report on the fisheries of the English lake district. London, 1878. x, 15 p. Appendix. 8°.

Add. 1878.1

Buckland, William [1784-1856] *Geologie und Mineralogie in Beziehung zur natürlichen Theologie*. Aus dem Englischen, nach der 2. Ausgabe des Originals, übersetzt und mit Anmerkungen und Zusätzen versehen von L. Agassiz. 2 vols. Neuchatel, 1838. 8°.

Add. 1838.1

See also Buckland, W., 1837.1

Buckley, Arabella B. Winners in life's race or the great backboned family. New York, 1891.

Add. 1891.1

Much about fishes.

Buckley, Thomas E., & Harvie-Brown, J. A. A vertebrate fauna of the

Orkney Islands. Edinburgh, 1891. 314 p. illust. Add. 1891.1

Fishes, p. 266-296.

Budge, J. Quergestreifte Muskel-fasern im Magen von *Cobitis fossilis*. Med. Zeit. Ver. Heilk. Preussen, 1847, 16. 4 p. Add. 1847.1

Buffon, G. L. L. [1707-1788] For biographies see Lebasteur, H. 1889.1; Vicq-d'Azyr, F. 1842.1.

Buglia, G., & Costantino, A. Beiträge zur Muskelchemie. Supplement zur IV. Mitteilung. Beobachtungen über die Wärmetrocknung des Muskelgewebes einiger Seetiere. Zeitschr. Physiol., Chem., 1913, 86, 137-140. Add. 1913.1

Beobachtungen an Scyllium.

Bullen, G. E., & Swithinbank, Harold. See **Swithinbank & Bullen.**

Buller, Nathan R. Fish for the masses. Rept. Dept. Fisheries Commonwealth Pennsylvania 1903-04 (1905), 124-127. Add. 1905.1

Buller, William. Experiments in rearing black bass. Rept. Dept. Fisheries Commonwealth Pennsylvania 1903-04 (1905), 135-137. Add. 1905.1

Bullmore, W. K. Cornish fauna, a short account of all the animals found in the county, with descriptions and remarks on the habits of many of the rarer birds, fishes, &c. procured during the last six years. Truro, 1867. 8°. Add. 1867.1

Bumpus, H. C. The importance of extended scientific investigation. Bull. U. S. Fish Comm. 1897 (1898), 17, 177-180. Add. 1898.1

Refers to development of fish culture and maintenance of fisheries.

Buonamici, Fr. Sulle Glossopetre, gli occhi de serpe, i Bastoncelli de M. Paolo, ed altre pietre figurate delle Isole de Malta e Gozzo. Opusc. Sci., (c. 1789), 12. Add. 1789.1

Burckhardt, Carl Rudolf. Weitere Mittheilungen über *Protopterus annectens* und über einem in seiner Chorda dorsalis vorkommenden Parasiten (*Amphistomum chordale*) Centralb. Bakt. Parasit., Jena, 1892, 11, 344-345. Add. 1892.1

Review of Burckhardt, C. R., 1891.1

— Der Bauplan des Wirbeltiergehirns. Morph. Arb., 1895, 4, Hft. 2, 131-150. Add. 1895.1

— [On some causes of brain-configuration in selachians] Nature, 1900, 62, 589. Add. 1900.1

— Die Entwicklungsgeschichte der Verknöcherungen des Integuments und der Mundhöhle der Wirbelthiere. (In Hertwig, O., Handbuch Entwicklungslehre der Wirbelthiere. Jena, 1906, vol. ii, pt. 1, p. 349-456. 56 figs.) Add. 1902.1

Fishes, p. 360-391. 21 figs.
This part appeared in 1902.

Burdon-Sanderson, J. See **Sanderson, J. Burdon.**

Burlend, T. H. The pronephros of *Scyllium canicula*. Zool. Jahrb. (Abth. Anat.) 1914, 37, 223-266. 8 pls. Add. 1914.1

Burnett, Waldo I. [Note on the breeding of muskellunge] Proc. Boston Soc. Nat. Hist., 1854, 4, 360. Add. 1854.1

— Researches on the development and intimate structure of the renal organs of the four classes of vertebrates. Amer. Journ. Sci. Arts, 1854, 2. ser. 17, 374-386. Add. 1854.2

Burns, Frank. Rockfish [Striped bass] in South Carolina. Bull. U. S. Fish Comm. 1886 (1887), 6, 124-125. Add. 1887.1

Burroughs, John. The halcyon in Canada (In Mayer, A. M. Sport with gun and rod, etc., p. 541-572. New York, 1883) Add. 1883.1
Sport fishing in Canadian waters.

Burrows, Guy. The land of the [African] pigmies. New York [1898] 299 p. illust. Add. 1898.1

Fishing with float [illust. p. 187]; with snare [illust.] p. 251; with arrows, p. 251; with poisons, p. 252.

Buschkiel, Alfred L. Beiträge zur Kenntniss der *Ichthyophthirius multifiliis* Fouquet. Arch. Protistenk., München, 1910, 21. Bd., 61-102. 2 pls. & text-fig. Add. 1910.1

List of fishes on which it is parasitic.

Buschman, C. H. Hatcheries and the disposition of the salmon packers. Pacific Fisherman, Seattle, 1914, 12, no. 11, 17-18; 99-102. Add. 1914.1

Buschman, C. H.

—— Traps: their purpose and their place in the Pacific coast salmon fishery. *Pacific Fisherman*, Seattle, 1914, **12**, no. 4, 12-14. Add. 1914.2

Butts, Charles. Fossil faunas of the Olean quadrangle. *Bull. N. Y. State Mus.*, 1903, no. 69. — 56th Ann. Rept. N. Y. State Mus., **2**, 990-995. Add. 1903.1

Butts, S. Improvements necessary in the hatching of salmon. *Trans.*

Pacific Fisheries Soc. 1914 (1915), 81-83. Add. 1915.1

Buxton, D. W., & Ringer, Sidney.
See **Ringer & Buxton.**

Buxton, S. Fishing and shooting. London, 1902. 282 p. 6 pls. illust. 8°. Add. 1902.1

Byrne, L. W. Fishes and fishing (In Fowler, G. Herbert, *Science of the sea, etc.*, New York, 1912) Add. 1912.1

C

C., N. Haringvisscherij van de Scheveningsche vloot in 1904. Tijdschr. Vereen. Nederl. Zeewesen, 1905, jaarg. 4, 287. Add. 1905.1

Calderon y Arana, Laureano. Peces de las pesquerias andaluzas existentes en el gabinete de la Universidad de Sevilla. Ann. Soc. Nat. Hist., Madrid, 1889, 18, 124-126. Add. 1889.1

Calderwood, W. L. Grayling and Loch Leven trout in salt water. Journ. Mar. Biol. Assoc., 1891-92, n. s. 2, 76-77. Add. 1891.1

— Notes on *Raia alba* (Lacép.) Journ. Mar. Biol. Assoc., 1891-92, n. s. 2, 396. Add. 1892.1

— *Polyprion cernium* Val. Journ. Mar. Biol. Assoc., 1891-92, n. s. 2, 396. Add. 1892.2

— British sea fisheries and fishing areas, in view of recent national advance. Scott. Geog. Mag., 1894, 10, 69-81. Add. 1894.1

— The feeding ground of the herring. Nature, 1895-96, 53, 54-55. Add. 1895.1

— Reports on Scottish salmon fisheries. 17. Ann. Rept. Fish. Board Scotland, 1899, pt. 2, p. 3-12. — 18. Rept., 1900, pt. 2, p. 3-13. Add. 1899.1

— Life of the salmon, with reference more especially to the fish in Scotland. London, 1907. 184 p. illust. 8°. Add. 1907.1

— Results of Salmon marking. Seventh paper. Rept. Fisheries Board Scotland, Salmon Fisheries, 1910 (1911), no. 2, 11-16. Add. 1911.1

— A study of three fish received as "mended male kelts." Rept. Fisheries Board Scotland, Salmon Fisheries, 1910 (1911), no. 3, 17-20. 2 pls. Add. 1911.2

— Salmon fisheries. 32. Ann. Rept. Fisheries Board Scotland, 1913 (1914), 247-254. Add. 1914.1

— Salmon research in 1913. I. Sea netting results. II. Results of salmon marking in rivers. 9th paper. III. The spawning mark on salmon scales. A review. Rept. Fisheries Board Scotland, Salmon Fisheries, 1913 (1914), no. 1-3, 1-26. Add. 1914.2

Call, R. Ellsworth. Fishes and shells of the falls of the Ohio (In Johnston, J. Stoddard (editor) Memorial History of Louisville. [1896], 1, 9-20). Add. 1896.1

Camera, — Notice sur l'ichthyocolle fournie par différentes espèces de *Gadus* que l'on pêche au Brésil. Ann. Chim. (Journ. Fourcroy), 1789, 1, 364.

Camerarius, Joannes Rudolph [1665-1721] De respiratione piscium. Oekon. Phys. Abhandl., 1760, 17, 43. Add. 1760.1

Cameron, A. T. The distribution of iodine in plant and animal tissues. Trans. Roy. Soc. Canada, 1914, 3. ser. 8, 4. sect., 7-10. Add. 1914.1

Camp, Samuel G. The fine art of fishing. New York, 1911, ix, 177 p. 12 pls. 12°. Add. 1911.1

— Fishing with floating flies. New York, 1913. 123 p. 12°. Add. 1913.1

Camp, W. E. Reconstructions illustrating the development of the supra-pericardial body in *Squalus acanthias*. Anat. Record, 1914, 8, 143-144. Add. 1914.1

Campbell, A. Memorandum on the "Bora Chung" of Bootan. Journ. Asiat. Soc. Bengal, 1842, 11, pt. 2, 963-964. Add. 1842.1

A fish which makes and lives in a tube in the bank under water.

Campbell, E. W. Causes leading to the disappearance of the black 'bass. Rept. Dept. Fisheries Commonwealth Pennsylvania 1903-04 (1905), 122-124. pl. Add. 1905.1

Campbell, J. MacNaught. The swordfish (*Xiphius gladius*, L.) in the

Campbell, J. M.

Firth of Forth. *Ann. Scott. Nat. Hist.*, 1893, 247. Add. 1893.1

— Notes on the natural history of the Bell Rock [lighthouse, Scotland] Edinburgh, 1904. 112 p. fig. Add. 1904.1

Many notes on habits of fishes.

Camper, Peter [1722–1789] A notice of Camper's life and writings by his son, and eulogies by Vicq-d'Azyr and Condorcet, may be found in his *Oeuvres* listed below. For a memoir, see Jardine's *Naturalist's Library*, vol. XI, 1835; or 2nd ser., vol. XXI, 1846–48.

— *De auditu piscium squamosorum*. Act. Harlem., 1763, 7, 79.

Add. 1763.1

— *Redevoeringen over de wijze om de verscheidene hartstogten op onze wezens te verbeelden; over de verbaazende overeenkomst tusschen de viervoetige dieren, de vogelen, de vischen en den mensch; en over het gedaanteschoon*. Utrecht, 1792. 4°.

Add. 1792.1

The original ed. A German version appeared, Berlin, 1793. One in French is:

— *Discours sur le moyen de représenter d'une manière sûre les diverses passions qui se manifestent sur le visage, sur l'étonnante conformité qui existe entre les quadrupèdes, les oiseaux, les poissons et l'homme; et sur le beau physique; publiés par A. G. Camper*. Utrecht, 1792. 11 pl. 4°. Add. 1792.2

— *Oeuvres de P. Camper qui ont pour objet l'histoire naturelle, la physiologie et l'anatomie comparée*. [edited with a preface by H. J. Jansen] 3 vols. Paris, 1803. Atlas 34 pls. 8° & fol.

Add. 1803.1

Camus, A. G. *Histoire des animaux d'Aristote*. 2 vols. Paris, 1783.

Add. 1783.1

Camus, L., & Gley, E. *Recherches sur l'action physiologique du sérum d'anguille. Contribution à l'étude de l'immunité naturelle et acquise*. Arch. Intern. Pharmacodynamie, 1898, 5, 247–305. — *Ann. Inst. Pasteur*, 1899, 13, 779.

Add. 1898.1

Canaud, J. L. *Hygiène et pisciculture: destruction moustiques à l'aide de certains poissons*. Paris, 1913. 140 p.

Add. 1913.1

Canavari, Igino. *La fauna dei calcari marmosi da cemento delle vicinanze*

di Fabriano. *Palæontographia Italica*, 1910, 16, 71–118. 7 pls. & 2 figs. Also separate.

Add. 1910.1

— *Sopra un importante resto di Ptychodus trovato a Gallio (Sette Comuni) nel Cretaceo superiore*. Atti Soc. Toscana Sci. Nat. Pisa, Proc. Verb., 1914, 23, 43–44.

Add. 1914.1

Cancrin, Franz Ludwig von. *Abhandlung von dem Anlegen, dem Bau und der Ausbesserung der Teiche, und besonders der Fischteiche*. Frankfurt-am-Main, 1791. 2 pls. 8°.

Add. 1791.1

Candiotti, Ch. *Crustacé parasite de la morue*. Soc. Océanograph. Golfe de Gascogne, Bordeaux, 1910, fasc. 5. 3 p. pl.

Add. 1910.1

Canestrini, Alessandro. *Lo stabilimento di piscicoltura di Torbole (Salmo)* Atti Accad. Agiati Rovereto, 1914, 4. ser., 4, 19–31.

Add. 1914.1

Canestrini, Giovanni. *Zur Systematik und Charakteristik der Anabatinen*. Verh. Zool.-Bot. Ges. Wien, 1860, 10, 697–712.

Add. 1860.1

Describes *Sphærichthys* Canestrini; orthotype *S. osphromenoides* Canestrini, p. 707; *Trichopsis* (Kner) Canestrini; orthotype *T. striatus* Blkr. A synonym of *Stenops* McCl., p. 708.

Canestrini, Riccardo. For biography and list of works see Bull. Soc. Sci. Padova, 1891–94, 5, 47–54.

— *Nota sulla voracità del luccio*. Bull. Soc. Sci. Padova, 1884–86, 3, 100–103.

Add. 1886.1

Cannieu, —. *Recherches anatomiques sur les ganglions cérébro-spinaux des poissons cartilagineux*. Journ. Méd. Bordeaux, 1899, 29, 389.

Add. 1899.1

Cantraine, F. *Mémoire sur un poisson nouveau, trouvé dans le canal de Messine en Janvier, 1833*. Bull. Acad. Sci. Bruxelles, 1835, 2, 107–109. — *Mém. Acad. Sci. Bruxelles*, 10, 1–19. 2 pls.

Add. 1835.1

See also Cantraine, F. in vol. I, 1837.1

Canu, E. *Sur le fonctionnement et l'amélioration du service de surveillance des pêches maritimes*. Boulogne, 1894. 48 p.

Add. 1894.1

Capellini, G. *Della pietra leccese e di alcuni suoi fossili*. Mem. Accad. Sci. Instit. Bologna, 1878. 3. ser. 9.

Add. 1878.1

Cappeler, Mauriti. Ant. Historia M. Pilati. Basil, 1767. 4°. Add. 1767.1

"De ranis agit ex piscina S. Urbani, similibus ranarum Surinamensium, pariter in pisces degenerantibus. Reperiri bipedes & quadrupedes; illis inclusum piscem spithalmalem." — Haller.

See also Merian, M. S., Pre-Linn. 1719.1

Capsoni, U. Le "Pescaie" nel Friuli. Neptunia, Venezia, 1903, 18, 74-79. Add. 1903.1

Carcani, Paolo. Lettera sulla respirazione dei pesci. Opuscoli Scelti Sci., Milano, 1791, 14, 63-68. Add. 1791.1

Carlisle, Anthony. On a specimen of *Labrus maculatus* Bl. taken on the British coast. Proc. Zool. Soc. London, 1830-31 (1831), 17. Add. 1831.1

Carlson, U. Ueber die Zahnentwicklung bei einigen Knochenfischen. Zool. Jahrb., 1894, 8, 217-244. 2 pls. 2 text-figs. Add. 1894.1

Carney, George J. Flight of the flying-fish. Science, 1883, 1, 543. Add. 1883.1

Carpenter, Charles. What muskrats sometimes eat. Bull. U. S. Fish Comm., 1884, 4, 295. Add. 1884.1
Muskrats enemies of fish.

Carr, John. The samlet, botcher, and gillion. Mag. Nat. Hist., 1830, 3, 196. Add. 1830.1

Carradori, G. Esperienze ed osservazioni sulla respirazione dei pesci. Ann. Chem. Stor. Nat. (Brugnatelli), 1794, 5, 53-59. Add. 1794.1

See also Carradori, G., in vol. I, 1799.1

Carré, — & Mérieux, — See Mérieux & Carré.

Carrière, Justus. Neuere Untersuchungen über Parietalorgane. Biol. Centralbl., 1889-90 (1890), 9, 136-149. Add. 1890.1

Carroll, Dixie [*Pseudonym for Cook, C. B.*] Lake and stream game fishing. By Dixie Carroll. With introduction by James Keeley. Cincinnati, [1912] ill. 12°. Add. 1912.1

A practical book on the popular fresh-water game fish, the tackle necessary, and how to use it.

Carruccio, Antonio [1839-]. Sull'avvelenamento per ingestione di pesci; contribuzione allo studio dei pesci tossicofori indigeni d'esotici. Bull. R. Accad. Med. Roma, 1886-87, 8, 353-

366. — Spallanzani, Roma, 1887, 2. ser. 16, 206-214. Add. 1886.1

— Osservazioni anatomiche e zoologiche sopra due specie rare di pesci (*Trachypterus*, Gouan) del mare di Civitavecchia. Boll. Soc. Studi Zool., Roma, 1895, 4, 1-23. Add. 1895.1

Carter, August W. Temperature in relation to fish. Nature, 1887, 36, 213. Add. 1887.1

Carter, E. N. An experiment in feeding young large-mouth bass. Trans. Amer. Fisheries Soc., 1914, 71-72. Add. 1914.1

Cartier, O. Beiträge zur Entwicklungsgeschichte der Wirbelsäule. Zeitschr. Wiss. Zool., 1875, 25, supp., 65-76. pl. Add. 1875.1

Carus, Carl Gustav. Traité élémentaire d'anatomie comparée. 2 vols. Bruxelles, 1833. 808 p. Add. 1833.1
Translated from 2nd German edition by J. L. Jourdan.

Carus, Carl Gustav, Otto, Adolphus William, & D'Alton, Edward. Tabulae anatomicam comparativam illustrantes quas exhibuit. Textum in Latinum sermonem vertit A. F. A. L. Theinemann. Pars I-IX cum LXXIV tabulis. Lipsiae, 1828-1855. gr. fol. Add. 1828.1

Anatomy and embryology of elasmobranchs and bony fishes by Carus chiefly. Earliest figure of egg of *Ginglymostoma* and of uterine embryo of *Centrina*.

Cassagneaud, —. Squalé gris et pêché sur les côtes de la Rochelle. Ann. Acad. La Rochelle, 1886 (1887), no. 23, 75. Add. 1887.1

Cattaneo, G. Istologia e sviluppo del tubo digerente dei pesci. Atti Soc. Ital. Sci. Nat., Milan, 1886, 29, 65 p. 3 pls. Add. 1886.1

— Sulla formazione delle crypte intestinali negli embrioni del *Salmo salar*. Rendic. R. Instit. Lomb., Milan, 1886, 2. ser., 19, fasc. 9. Add. 1886.2

Caumont, — de. Epoque du frai des tanches. Bull. Soc. Linn. Normandie, Caen, 1858, 3, 128. Add. 1858.1

Cavanno, G. Doni di Nettuno. Notizie su le forme e la vita di pesci e di altri animali utili o curiosi dei nostri mari. Firenze, 1914. 304 p. 272 illust. 8°. Add. 1914.1

Cavazzani, E. L'ittiotossico nel *Petromyzon marinus*. Giorn. R. Accad. Med., Torino, 1892, 3. ser. **40**, 872-876. Add. 1892.1

See also Cavazzani, E., 1892.1.

Ceresole, Giulio. Una nuova malattia della carpe. Neptunia, Venezia, 1902, **18**, 219-223. Add. 1902.1

Bacterial disease.

Černavin, V. *Diptychus oschanini* (Berg). [Text in Russian] Věst. Rybopromyšl., Petrograd, 1914, 227-235. Add. 1914.1

Chabrillac, F. Sur quelques poissons fossiles [Cretaceous] de la province de Ceará au Brésil. C. R. Acad. Sci., Paris, 1844, **18**, 1007. Add. 1844.1

Chabry, Laurent Marie. Sur l'équilibre des poissons. Journ. Anat. (Robin), 1884, **20**, 387-392. Add. 1884.1

Chadwick, B. P. Young mackerel destroyed by small-meshed nets. Bull. U. S. Fish Comm., 1886, **6**, 193. Add. 1886.1

Chamberlain, Fred. M., & Bower, Ward T. Fishery industries (In Fishery and fur industries of Alaska in 1912. U. S. Bur. Fisheries Doc. 780. Washington, 1913, 18-73) Add. 1913.1

Chambers, E. T. D. "Maskinonge" is its name. Forest & Stream, 1904, **62**, 212. Add. 1904.1

— Maskinonge or mascalonge. Forest & Stream, 1904, **62**, 316. Add. 1904.2

Chapman, Frederick. On a new species of *Ceratodus* from the Cretaceous of New South Wales. Proc. Roy. Soc. Victoria, 1914, n. s. **27**, 25-27. pl. Add. 1914.1

C. wollastoni, n. sp. Metaceratodus, new subgenus.

Chapman, Henry Cadwallader. On what was found in the alimentary canal of *Lucioperca*. Philad. Med. Times, 1874, **4**, 209-210. Add. 1874.1

Parasitic worms.

Chappelle, Edward. Voyage of H. M. S. "Rosamond" to Newfoundland and the southern coast of Labrador. London, 1818. Add. 1818.1

Fishes, etc., p. 131-134.

Charrin, A. Maladie myxosporidienne des barbeaux. C. R. Soc. Biol. Paris, 1898, 10. sér. **5**, 1030. Add. 1898.1

Chase, Martin R. A histological study of sensory ganglia. Anat. Rec., 1909, **3**, 121-140. 23 figs. Add. 1909.1

Based largely on study of shark embryos.

Chautard, J. Note sur les formations éocènes du Sénégal. Bull. Soc. Geol. France, 1905, 4. ser. **5**, 143-146. Add. 1905.1

Chavannes, Auguste. [Notice sur les larves de distomes observées sur la fera (*Coregonus fera*)] Verh. Schweiz. Naturf. Ges. 1851, **36**, 210. Add. 1851.1

Cheney, A. Nelson. Breeding natural food artificially for young fish artificially hatched. Bull. U. S. Fish Comm. 1893 (1894), **13**, 277-279. Add. 1894.1

— Concerning brook-trout and conditions favorable to their propagation. 2. Ann. Rept. Comm. of Fisheries, Game & Forests, 1896 (1897), 195-198. Add. 1897.1

— The Hudson river as a salmon stream. Bull. U. S. Fish Comm. 1897 (1898), 247-251. Add. 1898.1

Cheney, A. Nelson, & Orvis, Charles F. (editors) See **Orvis & Cheney**.

Cheney, H. N. The pike. Forest & Stream, 1893, **40**, 319. Add. 1893.1

— The pikes. Forest & Stream, 1898, **50**, 330-331. Add. 1898.2

Chernisheff, S. P. Patho-anatomic alterations of central nervous system, produced by fish poisoning [Text in Russian] Vrach Zapiski, Moskau, 1899, **6**, 135-145. Add. 1899.1

Chevalier, — Mémoire sur la manière de faire la colle de poisson dans la Russie, avec une description particulière de cette manufacture en Angleterre. Obs. Phys. Hist. Nat. (Rozier), 1774, **3**, 374-382. Add. 1774.1

Chevallier, — Sur des cas de l'empoisonnement par des poissons. Journ. Chim. Méd., Paris, 1856, 4. sér. **2**, 85. Add. 1856.1

Chiarini, P. Cambiamenti morfologici che si verificano nella retina dei vertebrati per azione della luce e dell'oscurità. Parte 1. La retina dei pesci e degli anfibi. Boll. R. Accad. Med., Roma, 1904, **30**, 75-110. Add. 1904.1

Chidester, F. E. Twins in fish, one with a cyclopic deformity. *Anat. Record*, 1914, **8**, 367-369. 4 figs.

Add. 1914.1

Chierchia, G. The voyage of the "Vettor Pisani." *Nature*, 1884, **30**, 365.

Add. 1884.1

Capture of *Rhineodon typus*, the whale shark, in bay of Panama.

See also Günther, A. C. L. G., Add. 1884.1

Child, C. R. [Review of Prather, J. M., 1900.1 on the development of the hypophysis in *Amia calva*.] *Science*, 1900, **11**, 168.

Add. 1900.1

Chilton, Charles (editor) Reports on the geo-physics, geology, zoology, and botany of the islands lying to the south of New Zealand, based mainly on observations and collections made during an expedition in the government steamer "Hinemoa" in November, 1907. 2 vols. Wellington, New Zealand, 1909. illust. 4°. Add. 1909.1

Pisces, vol. ii, p. 585-598. fig.

Chisholm, George G. Handbook of commercial geography. 7 ed. London, 1908.

Add. 1908.1

Fisheries, p. 167-172.

Chittenden, — & Cummins, — On the relative digestibility of fish flesh in gastric juice. Rept. U. S. Fish Comm. 1884 (1886), **12**, 1109-1122.

Add. 1886.1

Cholmondeley-Pennell, Henry. [1837-] A popular history of British fresh-water fish, &c. London & New York, 1884. 425 p. illust. 12°.

Add. 1884.1

Choulant, Ludwig. Graphische Incunabeln für Naturgeschichte und Medicin. Enthaltend Geschichte und Bibliographie der ersten naturhistorischen und medicinischen Drucke des XV. und XVI. Jahrhunderts, welche mit illustrirenden Abbildungen versehen sind. Leipzig, 1858. 8°.

Add. 1858.1

Christensen, R. Zur Geschichte des Angelhakens. Deutsche Fischerei Zeitg., 1881, **4**, nos. 12 & 15. — Bull. U. S. Fish Comm. 1884, **4**, 282-286.

Add. 1881.1

Christian, F. W. The Caroline islands: travel in the sea of little lands. London, 1899. 412 p. illust.

Add. 1899.1

Fishing with hooks and tuba, p. 126, 244; native names of fishes, p. 352-355, 365, 372, 378.

— Eastern Pacific lands; Tahiti and the Marquesas islands. London, 1910, 269 p. illust. Add. 1910.1

Native names of fishes, p. 64-65 and appendix. Fishing methods, p. 65-66.

Christopher, Hermann. Aale auf Hochzeitsreisen. I. Nach den Tiefen des Weltmeeres. Wochenschr. Aquar.-Terrar. Kunde, 1914, **11**. Jahrg., 671-673; 680-681. figs. Add. 1914.1

Churchill, E. G. S. Tarpon fishing in Mexico and Florida. London, 1907. 74 p. illust. 4°. Add. 1907.1

Ciaccio, Giuseppe Vincenzo. Sur une particularité anatomique remarquable de l'œil de l'espadon (*Xiphias gladius*). Journ. Microg., 1883, **7**. année, 323-324. Add. 1883.1

— La terminaison des nerfs dans les plaques électriques de la torpille. Journ. Microg., 1888, **12**. année, 433-438. Add. 1888.1

— Nuove osservazioni sopra l'interna tessitura dei prismi elettrici delle Torpedini. Rendic. Accad. Sci. Bologna, 1894-95, **43**. Add. 1894.1

Čistovič, Fedor Jakovlevič. Etudes sur l'immunisation contre le sérum d'anguilles. Ann. Inst. Pasteur, 1899, **13**, 406-425. Add. 1899.1

Clark, A. Howard. Catalogue of fishery products, and of the apparatus used in their preparation. Washington, 1883. Add. 1883.1

Catalogue of the exhibit made by the United States of America at the Great International Fisheries Exhibition, London, 1883.

— Notes on the history of preparing fish for the market by freezing. Bull. U. S. Fish Comm. 1886 (1887), **6**, 467. Add. 1887.1

Clark, Frank Nelson. For memorial notice, see Bower, Seymour, in Trans. Amer. Fisheries Soc. 1910 (1911), **85**-94.

— [Reproduction of the tail of a fish destroyed by Achlya] Amer. Nat., 1874, **8**, 363-364. Add. 1874.1

— The self-picker [Apparatus for hatching and separating ova] Bull. U. S. Fish Comm. 1881, **1**, 62-65. Add. 1881.1

— Report of experiments for determining the smallest amount of water in which young shad and eggs can be

Clark, F. N. kept. Rept. U. S. Fish Comm. 1881 (1884), 9, 783-786. Add. 1884.1

— Personal fish-cultural reminiscences. Trans. Amer. Fisheries Soc. 1910 (1911), 319-322. Add. 1911.1

Clark, R. S. General report on the larval and post-larval Teleosteans in Plymouth waters. Journ. Mar. Biol. Assoc., Plymouth, 1914, n. s. 10, 327-394. 11 figs. map. Add. 1914.1

Clarke, Kit. Where the trout hide. New York, 1889. 115 p. ill. 16°. Add. 1889.1

Clarke, S. C. The game fishes of America. Amer. Angler, Dec. 15, 1883. Add. 1883.1

Contains the first record of oral gestation in *Felichthys felis*.

Clarkson, Robert Durward. On the nutritive value and relative digestibility of fresh fish. Part I. Introductory. 5. Ann. Rept. Fish. Board Scotland, 1887, 221-229. Add. 1887.1

Claus, C. Beiträge zur vergleichenden Osteologie der Vertebraten. Rippen und unteres Bogensystem. Sitzber. K. Akad. Wiss. Wien, 1876 (1877), 74, (1. Abth.), 785-818. Add. 1877.1

— Ueber die Herkunft der die Chordascheide der Haie begrenzenden äusseren Elastica. Anzeiger Akad. Wiss. Wien, Math.-Nat. Kl., 1894, 31, 118-122. Add. 1894.1

Clément, C. Sur la lamie long-nez, *Lamna cornubica* Schneider. Bull. Soc. Sci. Nat. Nîmes, 1876, 4. ann., 109. Add. 1876.1

Clément, S. La blennie cagnette (*Blennius cagnotta* Valenc.) Bull. Soc. Sci. Nîmes, 1886, 24-25. Add. 1886.1

Clementi, A. Ueber die Verbreitung der Arginase im Tierreiche. (Congr. intern. Fisiol.) Arch. Fisiol. Firenze, 1914, 12, 110. Add. 1914.1

"Bei Säugern, Amphibien und Fischen vorhanden."

Clercq, F. S. A. de, & Schmeltz, J. D. E. Ethnographische beschrijving van de west- en noordkust van Nederlandsch Nieuw-Guinea. Leiden, 1893. xv, 300 p. 42 pls. 51 figs. Add. 1893.1

Fishing implements, p. 100-104. Hunting and fishing, p. 217-218.

Cleves, Victor de. Les poissons russes. La Nature, 1901, 29, pt. 2, 526. Add. 1901.1

Cligny, Adolphe. Croissance de la plie. Ann. Stat. Aquicult. Boulogne-sur-Mer, 1905, n. s. 1, 101-102. Add. 1905.1

— Les prétendues migrations du hareng. Ann. Stat. Aquicult., Boulogne-sur-Mer, 1907. 16 p. 4°. Add. 1907.1

— Repeuplement des rivières du Pas-de-Calais. Ann. Stat. Aquicult., Boulogne-sur-Mer, 1907. 11 p. 4°. Add. 1907.2

— La truite de mer, *Salmo trutta*. Ann. Stat. Aquicult., Boulogne-sur-Mer, 1907. 47 p. 4°. Add. 1907.3

— Deux clupéides à supprimer de la nomenclature; contribution à l'étude de nos scorpenides; un nouveau zéide du Maroc. Ann. Stat. Aquicult., Boulogne-sur-Mer, 1909. 24 p. 4°. Add. 1909.1

— Poissons des côtes d'Espagne et du Portugal (océan Atlantique) Ann. Stat. Aquicole, Boulogne-sur-Mer, 1913, n. s. 1, 1-30; 69-92. Add. 1913.1

— Sardines et pseudo-sardines; contribution à l'histoire de la pêche et de l'industrie sardinière. Ann. Stat. Aquicole, Boulogne-sur-Mer, 1913. 27 p. — Bull. Trim., Enseign. Pêches Maritimes, Paris, 1913, 18, 281-315. Add. 1913.2

Bibliography of sardines included.

— Contribution à l'étude biologique du hareng. Ann. Stat. Aquicole, Boulogne-sur-Mer, 1914, n. s. 1, 31-67. Add. 1914.1

— Documents relatifs à l'histoire de la pêche sardinière. Bull. Soc. Nat. Acclim., Paris, 1914, 61, 513-531. Add. 1914.2

Clinton, — Die Geheimnisse der Angel- und Netzfischerei. Jüterbog, 1849. Add. 1849.1

Translated by J. E. von Reider.

Cloquet, Hippolyte [1787-1840] Ichthyque (Fish poisoning) (In Dictionnaire des sciences naturelles, vol. xxii, p. 550-554. Paris, 1821) Add. 1821.1
Called Ciguatera in the West Indies.

Clutterbuck, J. W. Fish ova not eaten by the water ouzel. Zoologist, 1863, 21, 8693. Add. 1863.1

Cobb, Eben W. Commercial trout hatcheries and their influence on public hatcheries. Trans. Amer. Fisheries Soc. 1910 (1911), 173-178. Add. 1911.1

Cobb, John N. The fisheries of the Pacific coast. Trans. Amer. Fisheries Soc., 1914, 61-64. Add. 1914.1

— The future of Alaska's fisheries. Pacific Fisherman, Seattle, 1914, 12, no. 11, 11-16. Add. 1914.2

— New methods in Pacific coast fisheries. Pacific Fisherman, 1914, 12, 15-32. 4 figs. Add. 1914.3

— The Pacific Fisheries Society. Trans. Amer. Fisheries Soc., 1914, 65-66. Add. 1914.4

— Some neglected fishery resources of the Pacific coast. Pacific Fisherman, 1914, 13, 14-15. — Trans. Pacific Fisheries Soc., 1914 (1915), 39-50. Add. 1914.5

Cobb, J. N., Smith, H. M., Evermann, B. W., & Kendall, W. C. See **Smith, Evermann, Cobb, & Kendall.**

Cobbold, Thomas Spencer. Remarks on the entozoa and ectozoa of fish. Veterinarian, London, 1873, 4. ser. 19, 671-673. Add. 1873.1

— Tapeworms in trout. Field, London, 1873, 42, 109. Add. 1873.2

— A new entozoon from a fish. Sci. Gossip, London, 1876, 89. Add. 1876.1

— Parasitic disease in batrachia and salmonidæ. Veterinarian, London, 1880, 53 (4. ser. 26), 373-378. Add. 1880.1

Cobo, Bernabé. Historia del nuevo mundo per el P. Bernabé Cobo, de la Compania de Jesus. Publicada por primera vez con notas y otras ilustraciones de D. Marcos Jimenez de la Espada. 4 vols. Soc. Bibliof. Andaluces, Sevilla, 1890-93. 4°. Add. 1891.1

Fishes, vol. ii, p. 127-131; 149-190. Fishing with the remora, vol. ii, p. 180-181.

Cocco, Anastasio [1799-1854] For biography and works see Atti Soc. Tosc. Sci. Nat. (Mem.), Pisa, 1891, 11, 173-212.

— Su di alcuni nuovi pesci del mar di Messina. Giorn. Sci. Lett. Arti Sicilia, Palermo, 1829, 26 (ann. 7), 138-147. Add. 1829.1

— Sullo *Schedophilus medusophagus*. Giorn. Cabin Messina, 1829, 1, 30-32. — [not seen] Also quoted as Giorn. Innominato Messina Ann., 1829, 3, 57. Add. 1829.2

— Cenni sul genere *Ruvettus* e sui caratteri che lo distinguono. Osservatore Peloritani, 1833 (April 13). Add. 1833.1

P. 18, *Ruvettus*; orthotype *R. pretiosus* Cocco.

Cockerell, Sydney C. (compiler) Burlington Fine Arts Club Exhibition, 1908. Manuscripts xxviii, 133 p. 162 pls. Add. 1908.1

Introduction, 18 p. Exhibits nos. 80-83 are of illuminated manuscripts from the 12th and 13th centuries, some containing illustrations of fishes.

Cockerell, Theodore Dru Alison [1866-] Flat-fishes. Nature, 1890, 42, 53-54. Add. 1890.1

— The fauna of the Florissant (Colorado) Shales. Amer. Journ. Sci., 1913, 4. ser. 36, 498-500. Add. 1913.1

— The scales of the South American characinid fishes. Ann. Carnegie Mus., Pittsburgh, 1914, 9, 92-113. 6 pls. Add. 1914.1

Codrington, R. H. The Melanesians: studies in their anthropology and folk-lore. Oxford, 1891. Add. 1891.1

Fishing methods, 316-319: hooks, nets, shooting and spearing, pots, poison, kites, spider-web nets, noosing, traps, etc.

Cohen, Philip. Marine fish and fisheries of New South Wales, past and present, in their commercial aspect. Sydney, 1892. 30 p. 8°. Add. 1892.1

Prepared for the World's Columbian Exposition, Chicago, 1893.

Coker, Robert E. Condicion en que se encuentra la pesca marina desde Paíta hasta Bahía de la Independencia. Bol. Ministerio Fomento, Lima, Peru, 1908, 6, 53-117. Add. 1908.1

— Condiciones de la pesquería en Mollendo. Bol. Direc. Fomento, 1910, 8, 50-64. Add. 1910.1

— Estudio sobre la pesca en el Peru. Bol. Direc. Fomento, 1910, 8, 8-16. Add. 1910.2

— El Lago Titicaca y sus recursos. Bol. Direc. Fomento, 1910, 8, 29-39. Add. 1910.3

— Lake Titicaca, "The most remarkable lake of the World." Internat.

Coker, R. E.

Rev. Gesamt. Hydrobiol. Hydrograph., 1911, **4**, 174-182. Add. 1911.1

— Las industrias de la pesca y del guano en el Peru. Ann. Direc. Fomento, 1913, **1**, 28-69. Add. 1913.1

Translation of 1908.1

— Water-power development in relation to fishes and mussels of the Mississippi. Rept. U. S. Comm. Fisheries, 1913 (1914), append. 8, 1-28. 6 pls. Add. 1914.1

Cole, F. J. Notes on the vascular system of Myxine. Anat. Anz., 1914, **46**, 478-485. fig. Add. 1914.1

Coles, Russell Jordan [1865-] Effect of thunder on fishes. Copeia, 1914, no. 5, 1. Add. 1914.1

Collier, J. H., & Hooper, J. The American parlor aquarium or fluvial aqua vivarium. New York, 1866. 143 p. illust. 12°. Add. 1866.1

Collinge, Walter Edward [1867-] Lecture on the "sensory canal system of fishes." Trans. Caradoc Field Club, 1893-96, **1**, 71-72. Add. 1893.1

Collingwood, Cuthbert. Remarks upon some oceanic forms of hydrozoa observed at sea. Ann. Mag. Nat. Hist., 1867, 3. ser. **20**, 309-314. Add. 1867.1

Fishes living in association with pelagic medusæ, p. 311.

— Rambles of a naturalist on the shores and waters of the China seas. London, 1868. Add. 1868.1

Numerous general notes on fishes; also flying-fishes, commensal fishes, etc.

Collins, A. S. Shad eggs. Amer. Naturalist, 1871, **5**, 441. Add. 1871.1

Increase in size after impregnation.

Collins, Joseph. Catalogue of the collection illustrating the fishing vessels and boats, and their equipment; the economic condition of fishermen; angler's outfits, etc. London, 1883. Add. 1883.1

Catalogue of the exhibit made by the United States of America in the Great International Fisheries Exhibition, London, 1883.

— Inauguration of the frozen herring trade. Bull. U. S. Fish Comm. 1884, **4**, 81-83. Add. 1884.1

— Notes on the habits and methods of capture of various species of sea birds that occur on the fishery banks off

the eastern coast of North America, and which are used as bait for catching codfish by New England fishermen. Rept. U. S. Fish Comm. 1882 (1884), **10**, 311-338. pl. Add. 1884.2

— Some observations on the cod gill-net fisheries and on preservatives for nets. Bull. U. S. Fish Comm. 1884, **4**, 58-59. Add. 1884.3

— Edible qualities of the smoked kingfish (*Scomberomorus cavalla*, Cuv.) Bull. U. S. Fish Comm. 1885, **5**, 359. Add. 1885.1

— Fishing on an edge of the Grand Banks. Bull. U. S. Fish Comm., 1885, **5**, 256. Add. 1885.2

— Proposition to prepare kingfish by smoking. Bull. U. S. Fish Comm. 1885, **5**, 360. Add. 1885.3

— A curious knife found in the flesh of a codfish. Bull. U. S. Fish Comm. 1886, **6**, 381-383. fig. Add. 1886.1

— Gill-nets in cod fishery; a description of Norwegian cod nets, etc., and a history of their use in the United States. Rept. U. S. Fish Comm. 1884 (1886), **12**, 265-288. 12 pls. Add. 1886.2

— The gill-net cod fishery (In The fisheries and fishery industries of the United States, edited by George Brown Goode, sect. 5, vol. i, p. 225-233. 9 pls. 1887) Add. 1887.1

— The beam-trawl fishery of Great Britain, with notes on beam-trawling in other European countries. Bull. U. S. Fish Comm. 1887 (1889), **7**, 289-407. 23 pls. & 34 figs. Add. 1889.1

— Some reasons why the fishermen of Nova Scotia use salt clams (*Mya arenaria*) for bait in the Bank handline cod fisheries. Bull. U. S. Fish Comm. 1887 (1889), **7**, 425-428. Add. 1889.2

— Suggestions for the employment of improved types of vessels in the market fisheries, with notes on British fishing steamers. Bull. U. S. Fish Comm. 1888 (1890), **8**, 175-192. 12 pls. Add. 1890.1

— The fishing vessels and boats of the Pacific coast. Bull. U. S. Fish Comm. 1892, **10**, 13-48. 12 pls. 4 text-figs. Add. 1892.1

— Report upon the division of fisheries. Rept. U. S. Fish Comm. 1889 (1892), **16**, cix-cxxi. Add. 1892.2

— Report upon the participation of the United States Fish Commission in the centennial exposition held at Cincinnati, Ohio, in 1888. Rept. U. S. Fish Comm. 1889 (1892), **16**, 869-885. pl. Add. 1892.3

— [On fisheries and the organization of fishermen] Trans. Amer. Fisheries Soc., 1894, 84-92. Add. 1894.1

— Report of the United States commissioner to the International Fisheries Exhibition of 1898 at Bergen, Norway. Senate Doc. no. 39, 56. Congress. Washington, 1901. Add. 1901.1

Extensive report on fishery apparatus and appliances.

Collins, J. W., & Goode, George Brown. See **Goode & Collins.**

Collins, Wilkie. The pilchard fishery on the coast of Cornwall. Harper's Mag., 1851, **2**, 630-633. Add. 1851.1

Colnett, James. A voyage to the south Atlantic and round Cape Horn into the Pacific ocean for the purpose of extending the spermaceti whale fisheries, etc. London, 1798. 179 p. charts. Add. 1798.1

Contains many incidental notes on fishes, (sharks, etc.)

Colomina, Alejandro de. Nota sobre un *Orthogoriscus oblongus*, Schn. pescado en la ría de Pontevedra. Bol. Soc. Españ. Hist. Nat., 1910, **10**, 453-456. fig. Add. 1910.1

Colquhoun, John. The moor and the loch: practical hints on highland sports, game and prey in the mountains of Scotland, with an essay on loch fishing. 2. ed. London, 1841. illust. 8°. Add. 1841.1

Comarmoud, — Mémoire de la pisciculture de la truite, en particulier de celle du lac de St. Froot. Lyon, 1853. 54 p. Add. 1853.1

Compton, T. A Mendip valley. London, 1892. illust. 8°. Add. 1892.1
Fishes of the district.

Condorelli - Francaviglia, Mario. Contributo allo studio della fauna elmintologica di taluni pesci della prov. di Roma. Boll. Soc. Rom. Stud. Zool., Roma, 1898, **7**, 110-144. pl. Add. 1898.1

— Ricerchi sui vermi parassiti del *Gobius avernensis* Cenestr. — Boll. Soc. Rom. Stud. Zool., Roma, 1898, **7**, 1-17. pl. Add. 1898.2

Configliacci, Pietro [1779-1844] Sull' analisi dell' aria contenuta nella vescica natatoria dei pesci. Giorn. Fis. Chem. Stor. Nat. (Brugnatelli), 1809, **2**, 347-376, 381-409, 477-497. — Journ. Chem. Phys. (Schweiggers), 1811, **1**, 137-163. Add. 1809.1

Complete reference for Configliacci, P., 1809.1.

— Ueber die Analyse der Luft aus der Schwimmblase der Fische. Beiträge Chem. Phys., (Schweigger), Nürnberg, 1811, **1**, 137-163. Add. 1811.1

Conn, C. *Betta bellica* Sauv. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 401-402. 2 figs. Add. 1914.1

— Geschlechtsunterschied bei *Pterophyllum scalare*. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 508. Add. 1914.2

— Ein neuer Cichlide aus Afrika. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 346-347. fig. Add. 1914.3

— *Pterophyllum scalare*. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 492-494; 508. fig. Add. 1914.4

— *Scatophagus argus*. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 369-371. fig. Add. 1914.5

Connorton, J. G. A list of the most common fishes, etc., on the southeast coast of Madagascar. Antananarivo Annual, 1892, 259-263. Add. 1892.1

Conrad, T. A. Catalogue of Eocene shells and fish from Shark river. (In Geological Survey of the State of New Jersey, appendix A. 1868. 8°.) Add. 1868.1

Cook, C. B. See **Carroll, Dixie.**

Cooke, M. C. [Fungi producing disease in fish] Journ. Roy. Micr. Soc., 1880, **3**, pt. 2, 998. Add. 1880.1

Coombe, Florence. Islands of enchantment: many-sided Melanesia. London, 1911. Add. 1911.1

Shark-worship, p. 116, 248-251, 279, 329. Noosing sharks, 173, 188. Kite-fishing, 277. Spider web lure, 173. Fishing for b — 257, 366.

Cope, Edward Drinker [1840-1897] For biographies see Osborn, H. F., 1897.3, 1898.1.

Cope, E. D.

— Fishes of the Ambyiacu river [Upper Amazon] Amer. Naturalist, 1871, **5**, 378–379. Add. 1871.1

See also Cope, E. D., 1871.13.

— Synopsis of new vertebrata from the Tertiary of Colorado, obtained during . . . 1873. (Extracted from 7. Ann. Rept. Geog. Geol. Survey, etc. Washington, 1873. 19 p. 8°.) Add. 1873.1

"Only quasi extracted from the report of which it ostensibly forms part. It was published in advance of the 7th annual report as a separate pamphlet; and finally appeared in that report so much modified as to be in effect a different article." — (Catalogue of Publications, 3. ed.)

— Description of some species of reptiles obtained by Dr. John F. Bransford . . . U. S. N., while attached to the Nicaraguan Surveying Expedition in 1873. Proc. Acad. Nat. Sci., Philad., 1874, **26**, 64–72. Add. 1874.1

Describes *Protistius semotilus*, n. g. et n. sp., p. 66, from Peruvian Andes.

— Descriptions of some vertebrate remains from the Fort Union beds of Montana. Proc. Acad. Nat. Sci. Philad., 1876, 1–14. Add. 1876.1

Ceratodus eruciferus and *C. hieroglyphus*, n. sps., *Myledaphus bipartitus*, n. g. et n. sp.

— The fisheries of Pennsylvania. Rept. Fish Comm. Pennsylvania, 1881–82 (1883), 103–194. Add. 1883.1

The title is so printed; it should read: "The Fishes of Pennsylvania."

— A contribution to the vertebrate palæontology of Brazil. Proc. Amer. Phil. Soc., 1886, **23**, 1–21. pl. Add. 1886.1

Cretaceous fishes, p. 2–7.

— Edestus and Pelecopterus, etc. Geol. Mag., 1886, **3**, 141. Add. 1886.2

— The most southern salmon. Amer. Naturalist, 1886, **20**, 735. Add. 1886.3

— On the structure of certain Palæozoic fishes. Proc. Amer. Assoc. Adv. Sci., 1890, 336. Add. 1890.1

Coquand, H. Description physique, géologique paléontologique et minéralogique du département de la Charente. 2 vols. Besançon, 1858–60. 8°. Add. 1860.1

Describes *Orthodon condamyi*, n. g. et n. sp., from Cretaceous of Charente Dept., France [vol.ii, p. 126].

Corblin, Henri. Recherches expérimentales sur la locomotion du poisson. Arch. Physiol., 1888, **1**, 145–173. Add. 1888.1

Cordeaux, Jno. *Chimæra monstrosa* in the North sea. Naturalist, 1898, 206. Add. 1898.1

Cornalia, Emilio. A new fish parasite. Pop. Sci. Rev. London, 1877, **16** (n. s. 1), 103. Add. 1877.1
Review of Cornalia, E., 1875.1

Cornay, J. E. Sur un cas de mopsie observé chez une truite saumonée. C. R. Acad. Sci. Paris, 1847, **25**, 116–118. Add. 1847.1

Corning, H. K. Ueber die vergleichende Anatomie der Augenmuskulatur. Morph. Jahrb., 1900, **29**, 94–140. Add. 1900.1

Cornish, C. J. Animals at work and play; their activity and emotions. London, 1896. 323 p. illust. 8°. Add. 1896.1

The invisible food of fishes, p. 240.

— The naturalist on the Thames. London, 1902. 260 p. illust. 8°. Add. 1902.1

Fishes and fishing.

Cornish, G. A. Notes on fishes of Tignish, Prince Edward island. Contrib. Canadian Biol. (Suppl. Ann. Rept. Dept. Mar. Fisheries, Fisheries Branch) 1906–10 (1912), 79–81. Add. 1912.1

Cornish, Thomas [1830–] For biography see Zoologist, 1891, **15**, 33–34. — Trans. Penzance Soc., 1880–84, 436.

— [A ling which had practically developed five backbones] Trans. Penzance Soc., 1880–84, **I**, 436. Add. 1884.1

Corré, A. Analogie des symptômes et des lésions chez les individus mordus par des serpents venimeux et chez les individus empoisonnés par certains poissons. Arch. Physiol., Paris, 1871–1872, **4**, 405. Add. 1872.1

— Nouvelle note relative aux poissons vénéneux. Archiv. Méd. Navale, 1881, **35**, 63–67. Add. 1881.1

Corso, F. Quelques expériences sur le cervelet des poissons. Arch. Ital. Biol., 1895, **22**, xciv. Add. 1895.1

Cort, William Walter. Notes on the trematode genus *Clinostomum*. Trans. Amer. Fisheries Soc., 1913, **32**, no. 3, 169. Add. 1913.1

Costa, Oronzio Gabriele [1787-1867] Paleontologia del regno di Napoli. Parte I. Atti Accad. Pont., Napoli, 1853, **5**, 233-433. Parte II. *Ibid.*, 1856, **7**, pt. 1, 1-378. Parte III. *Ibid.*, 1864, **8**, 1-198. Add. 1853.1

— Ricerche dirette a stabilire l'età geologica della calcarea tenera a grana fina di Lecce, detta volgarmente leccese. Giorn. Gianbatista Vico, Napoli, 1857, **2**. Add. 1857.1

— Ricerche osteologiche sulla apparecchio pterigo-timpanico dei pesci. Giorn. Giambatt. Vico, Napoli, 1857, fasc. 3, 393-412. Add. 1857.2

— *Luspiacasotti* [Serranus], nuovo genere di pesci fossili della calcarea tenera leccese. Napoli, 1858. Add. 1858.1

— Studii sopra i terreni ad ittioliti, etc., (Parte I) schisti bituminiferi di Giffoni. Atti Accad. Sci. Napoli, 1862, **12**, append. Add. 1862.1

Giffonus, p. 26; orthotype, *G. deperditus* Costa. Urocomus, p. 32; orthotype, *U. picenus* Costa.

— Paleontologia delle province napoletane. Appendice I. Atti Accad. Pont., Napoli, 1864, **8**, append. Add. 1864.1

— Note geologiche e paleontologiche sui Monti Picentini nel Principato citeriore. Atti Ist. Incoraggiamento, Napoli, 1864, 2. ser. **1**. Add. 1864.2

Costantini, Luigi. Una grande "Conserva" per i pesci. Neptunia, Venezia, 1903, **18**, 145-146. Add. 1903.1

Pisciculture.

Coste, — Histoire générale et particulière du développement des corps organisés. Paris, 1847-1859. Add. 1859.1

Two plates given to development of Gasterosteus.

Cotte, J., Gaver, F. van, Stephan, P., & Darboux, G. See **Darboux, Stephan, etc.**

Coulter, John. Adventures in the Pacific, with observations on the natural productions, manners and customs

of the natives of the various islands. Dublin, 1845. 290 p. Add. 1845.1

Fishing in the Marquesas, with artificial minnows, with nets, by diving, pp. 156-161.

Coupin, Henri. Les poissons dangereux. Méd. Mod., Paris, 1899, **10**, 681-684. Add. 1899.1

— Ce que les poissons de mer font de leurs œufs. Cosmos, Paris, 1913, n. s. **68**, 373-374. Add. 1913.1

Coutance, H. A. Biological action of the salts contained in sea water from the point of view of maintenance of marine animals. Rept. U. S. Fish Comm. 1881 (1884), **9**, 749-754. Add. 1884.1

Coutinho, J. M. da Silva. Two letters (In Fletcher, J. C., & Kidder, D. P., Brazil and the Brazilians, 6. ed. Boston, 1866) Add. 1866.1

Oral gestation in *Acara* (*Geophagus*) *petroina* and other Cichlidæ, p. 627-633.

Cowan, Frank. A dictionary of the proverbs and proverbial phrases of the English language relating to the sea, and such associated subjects as fish, fishing, ice, island, navigation, etc. Greenburgh, 1894. 144 p. 8°. Add. 1894.1

Coward, T. A. Faunal survey of Rostherne mere. II. Vertebrata. Mem. Proc. Manchester Lit. Phil. Soc., 1914, **58**, no. 9. 37 p. Add. 1914.1

Cox, Philip. Catalogue of the marine and fresh-water fishes of New Brunswick. Bull. New Brunswick Nat. Hist. Soc., 1896, **3**, no. 13, 62-75. Add. 1896.1

— History and present state of the ichthyology of New Brunswick. Bull. New Brunswick Nat. Hist. Soc., 1896, **3**, no. 13, 27-61. Add. 1896.2

— Reduction in the number of fin-rays of certain flat-fishes. Proc. Miramichi Nat. Hist. Assoc., 1903, **3**, 42-47. Add. 1903.1

— Extension of the list of New Brunswick fishes. Proc. Miramichi Nat. Hist. Assoc., 1905, **4**, 41-44. Add. 1905.1

Cox, U. O. A preliminary report on the fishes of Minnesota. Geol. Nat. Hist. Surv. Minnesota, 1897, Zool. Ser. **3**. 93 p. Add. 1897.1

Crantz, David. See **Cranz, David.**

Cranz, David [1723-1777] *Historie von Grönland, etc.* 2 vols. Barby, 1765. fig. 8°. Add. 1765.1

Another edition, Barby, 1770.

— *Historie van Groenland, etc.* 3 vols. Haarlem, 1767. gr. 8°. Add. 1767.1

Another edition, 3 vols., Amsterdam, 1786.
Fishes and sea animals, I, p. 100-146.

— *The history of Greenland, etc.* 2 vols. London, 1767. 12°. Add. 1767.2

Vol. I, book i, chap. 2, "Of the fishes."
Another edition, 1820. Also in Prévost.
Hist. Gén. Voy. XXV: and Arkstee & Merkus, XX, 1771.

Crawshay, L. R. On the fauna of the outer western area of the English Channel. *Journ. Marine Biol. Assoc.*, Plymouth, 1910-13 (1912), n. s. 9, 292-393. pl. Add. 1912.1

Fishes, p. 383-386.

Crittenden, A. R. Catching alewives with hooks baited with eels. *Bull. U. S. Fish Comm.* 1884, 4, 255-256. Add. 1884.1

Cronheim, Walter. Die Pütter-schen Arbeiten über die Ernährung der Wassertiere. *Arch. Hydrobiol. Planktonkunde*, 1909, 4, 225. Add. 1909.1

Crook, A. R. The lithographic stone quarries of Bavaria, Germany. *Stone*, Chicago, 1894, 9, 379-390. Add. 1894.1
Contains figures of a number of fossil fishes.

Crooke, William. Things Indian; being discursive notes on various subjects connected with India. New York, 1906. Add. 1906.1

Sacred fish, 221-223.

Crowe, — Fish guano in Norway. *Journ. Soc. Arts*, 1882, 30, 346. Add. 1882.1

Crozier, William J., & Hecht, Selig. Correlations of weight, length and other body measurements in the weakfish, *Cynoscion regalis*. *Bull. Bur. Fisheries* 1913 (1914), 33, 141-147. figs. Add. 1914.1

Csengő, Nándor. A csuka fejevázáról [Ueber das Kopfskelet von *Esox lucius*] *Allatt. Közlem. Köt.*, 1914, 13, 107-127. 2 pls. fig. Add. 1914.1

Cuénot, Lucien. Les couleurs des poissons. *Naturaliste*, 1892, 2. ser. 6, 149-152. figs. Add. 1892.1

Cumming, Constance Frederica Gordon. See **Gordon-Cumming, Constance Frederica.**

Cummins, —, & Chittenden, —. See **Chittenden & Cummins.**

Cunningham (junior), J. H. Experiments on *Saprolegnia ferax*, and their application to the trout hatchery. *Journ. Boston Med. Soc.*, 1899-1900, 4, 55-66. 2 pls. Add. 1899.1

Cunningham, Joseph Thomas. On the reproductive elements in *Myxine glutinosa*, L. *Proc. Roy. Soc. Edinburgh*, 1886, 13, 597-602. Add. 1886.1

— Some notes on Plymouth fishes. *Journ. Mar. Biol. Assoc.*, 1887-88, 243-250. Add. 1887.1

— The habits of the cuckoo or boar-fish. *Journ. Mar. Biol. Assoc.*, 1888, 2, 243-245. Add. 1888.1

— Reproductive organs of the common sole. *Journ. Mar. Biol. Assoc.*, 1888, 2, 248-250. Add. 1888.2

— Breeding of fish in the aquarium. *Journ. Mar. Biol. Assoc.*, 1891-92 (1892), n. s. 2, 195. Add. 1892.1

— The protection of immature fish. *Rept. Brit. Assoc. Adv. Sci.*, 1892, 767-768. Add. 1892.2

— [On the significance of diagnostic characters in the Pleuronectidæ] *Nature*, 1894, 50, 436. Add. 1894.1

— [Fish and fishing grounds in the North Sea] *Nature*, 1895, 52, 562. Add. 1895.1

— Growth of fishes in the aquarium. *Journ. Mar. Biol. Assoc.*, 1893-95 (1895), n. s. 3, 167. Add. 1895.2

— Notes on rare or interesting specimens (*Clupea alosa*, *Auxis rochei*, *Thynnus thynnus*, *Myliobatis aquila*). *Journ. Mar. Biol. Assoc.*, 1893-95 (1895), n. s. 3, 274-277. Add. 1895.3

— Rearing of fish-larvæ. *Journ. Mar. Biol. Assoc.*, 1893-95 (1895), n. s. 3, 168. Add. 1895.4

— The species, the sex, and the individual. *Nat. Sci.*, 1898, 13, 184-239. Add. 1898.1

Conclusions largely drawn from study of fishes.

Cunningham, J. T.

— Reptiles, amphibia, fishes and lower chordata. London, 1912.

Add. 1912.1

Fishes, p. 231-471.

Curtis, Winterton C. *Crossobothrium laciniatum* and developmental stimuli in the Cestoda. Biol. Bull. 1888-90 (1890), **5**, 125.

Add. 1890.1

— The life history of *Scolex polymorphus*, of the Woods Hole region. Journ. Morph., 1911, **22**, 819.

Add. 1911.1

Curtis, W. C., & Lefevre, George. See **Lefevre & Curtis.**

Cuvier, (Baron) Georges Léopold Chrétien Frédéric Dagobert [1769-1832] For memoir and list of writings, see Bowdich (Mrs.), T. E. Memoirs of Baron Cu-

vier, with a list of his writings. New York, 1833. 120 p. 8°.

— Mémoire sur les os de reptiles et de poissons des carrières à plâtre des environs de Paris. (In his Recherches sur les ossements fossiles de quadrupèdes, etc. 1st ed. Paris, 1812. iii, 1-20 p. pl.

Add. 1812.1

A reprint of Cuvier, G., 1810.1.

— Des ossements et squelettes de poissons. (In his Recherches sur les ossements fossiles. 2. ed. Paris, 1822. iii, 338-349 p. pl. 76.)

Add. 1822.1

A new edition of the preceding.

— Die Zähne der Fische. Wiedemann's Archiv. Zool. Zoot., 1805, **3**, 205-214; 218-221.

Add. 1805.1

Cuvier, G., & Duvernoy, G. Leçons d'anatomie comparée. Paris, 1846.

D

D., G. Visscherij aan de zuid-west kust van Africa. Tijdschr. Vereen. Nederl. Zeewezen, 1905, 4. jaarg., 221. Add. 1905.1

D., J. A. D. On the breeding of fish and the natural history of their generation. Philos. Mag., 1809, 34, 368-372. Add. 1809.1

Consists of extracts from Hannöver. Mag., 1763, 1764, 1765.

See also Jacobi, S. L., 1763.1

Daday, Jenö. [Nematodes, rotatoria, crustacea, hydrachnida, mollusca and pisces of Lake Balaton.] (In Resultate der wissenschaftlichen Erforschung des Balatonsees, &c. Kir. Magyar Termész. Társulat, Budapest, 1897. 2. 4°.) Add. 1897.1

Dagry, A. Envoi d'alevins de carpes-miroirs à Tananarivo [Madagascar]. Bull. Soc. Acclim. France, Paris, 1914, 61, 505. Add. 1914.1

Dahlgren, Ulric [1870-] The electric motor nerve centers in the skates (Rajidae) Science, 1914, n. s. 40, 862-863. Add. 1914.1

Cells of the same origin as the motor cells of anterior horn. Aberrant nuclear type.

— Embryonic history of the electric apparatus in *Gymnarchus niloticus*. 9. Congr. Internat. Zool., Monaco, 1913 (1914), 379. Add. 1914.2

Preliminary to Dahlgren, U., 1914.1.

— The habits of *Astroscopus* and the development of its electric organs. 13. Yearbook Carnegie Instit. Washington, 1914, 201-203. Add. 1914.3

Details regarding electric organs derived from parts of at least three eye muscles on each side.

— A remarkable polarity in the motor nerve cells of the electric apparatus of *Tetronarce occidentalis*. C. R. 9. Congrès Intern. Zool., Monaco, 1914, 216. Add. 1914.4

Daland, Judson. Beri-beri due to decomposing fish. N. Y. Med. Journ., 1895, 61, 316-318. Add. 1895.1

Daldorf, D. C. de. Uddrag af Hr. Daldorf's Dagbog paa en Reise fra Kiøbenhavn til Tranquebar . . . 1 aaret 1790 . . . 1791. Skrivt. Naturhist. Selskab., 1793, 2, 157-160. Add. 1793.1

Smallest remora on record.

Dall, Wm. H. British Antarctic "Terra Nova" Expedition, 1910. [Review of Zoology, Vol. I, no. 1. Fishes by C. Tate Regan] Science, 1914, n. s. 40, 753. Add. 1914.1

D'Alton, Edward, Otto, Adolphus William, & Carus, Carl Gustav. See **Carus, Otto, & D'Alton.**

Dames, Wilhelm Barnim [1843-1898] Ueber *Ancistrodon* Debey. Zeitschr. Deutsch. Geol. Gesell., 1883, 35, 655-670. Add. 1883.1

Eocene and Oligocene fossil fish teeth.

— Ein mit hyperostotischen Bildungen versehener Schädel eines subfossilen *Pagrus* von Melbourne. Sitzber. Ges. Naturf. Freunde Berlin, 1890, 162-167. figs. Add. 1890.1

Dana, J. D., & Herrick, E. C. Description of *Argulus catostomi*, a new parasitic crustaceous animal. Amer. Journ. Sci. Arts, 1837, 31, 297. Add. 1837.1

Daniel, J. Frank. The anatomy of *Heterodontus francisci*. I. The exoskeleton. Univ. California Publ. (Zool.) 1914, 13, 147-166. 2 pls. 4 text-figs. Add. 1914.1

Dannevig, Alf. Undersøkelser over ørret og laks i Nidelvens nedre løp 1911-1913. [Investigations on trout and salmon in the lower part of the Nidlevan (Nid river).] Nyt Mag. Nat. Kristiania, 1914, 52, 175-216. 4 pls. Add. 1914.1

Dannevig, Harold Christian. Report on operations at Dunbar marine hatchery for the period July 1896 to December 1897, with some notes on rearing experiments with flat fishes. 16. Ann. Rept. Fishery Board Scotland, 1898, pt. 3, 219-224. Add. 1898.1

— Report on operations at Dunbar marine hatchery during the spring season 1898. 17. Ann. Rept. Fishery Board Scotland, 1899, pt. 3, 205-209.

Add. 1899.1

Dantziger, C., Freeden, W. v., & Rensen, P. v. See **Freeden, Dantziger, & Rensen.**

Darboux, G., Stephan, P., Cotte, J., & Gaver, F. van. L'industrie des pêches aux colonies françaises. Marseille, 1907. 800 p. figs. maps. 8°.

Add. 1907.1

Dareste, Camille. Recherches sur la production artificielle des monstruosités. C. R. Acad. Sci. Paris, 1861, **53**, 2. sem., 294-298.

Add. 1861.1

D'Argenville, Antoine Joseph Desalier. Nachricht von der besondern eigenschaft gewisser ostindischer fische, mit einem aus dem munde geworfenen wassertropfen insekten aus der luft herunter zu stürzen. Stralsund. Magaz., 1767, **1**, 58-63.

Add. 1767.1

Darwin, Charles Robert [1809-1872] For biography see Osborn, H. F. 1901.1

— Naturalist's voyage round the world. New ed. New York, 1872. x, 519 p. illust.

Add. 1872.1

Fishes, p. 136; 390-391; 464-465.

Davaine, Casimir-Joseph. Note sur une tumeur singulière contenant une quantité prodigieuse d'œufs d'helminthe, observée chez un poisson vulgairement nommé aigle-bar [*Sciaena aquila*]. C. R. Soc. Biol. Paris, 1854 (1855), 2. ser. **1**, 141-143. pl.

Add. 1855.1

— Sur une ligule (*Ligula minuta*) de la truite du lac de Genève. C. R. Soc. Biol. Paris, 1865, 4. ser. **16**, 87-88. — Gaz. Méd. Paris, 1865, **36** (3. ser. **20**), 437.

Add. 1865.1

David, R. Botulismus nach Genuss verdorbener Fische. Deutsch. Med. Wochenschr., Leipzig & Berlin, 1899, **25**, 127-130.

Add. 1899.1

David, (Mrs.) T. W. Edgeworth. Funafuti or three months on a coral island: an unscientific account of a scientific expedition. London, 1899. Add. 1899.1

Fish and fishing at Funafuti, 246-254. Fishing for palu, *Ruvettus*, 248-250.

David, T. W., & Pittman, E. F. Note on the stratigraphy of the fish-

bearing beds of the Talbragar River. Mem. Geol. Surv. New South Wales, Palæont., 1895, no. 9. 4°.

Add. 1895.1

Davidowsky, F. Glue, gelatin, animal charcoal, cements, pastes and mucilage (Translated by W. T. Brannt) Philadelphia, 1905.

Add. 1905.1

Valuable treatise on fish products.

Davidson, S. C. [On the discovery of isinglass] Journ. Asiatic Soc. Bengal, 1839, **8**, 684-685.

Add. 1839.1

Davies, E. W. L. Our sea-fish and sea-food. London, 1887. 128 p.

Add. 1887.1

Davies, Mark. Some random notes by an old angler on fishes of the Lea. Essex Naturalist, 1900, **11**, 133-135.

Add. 1900.1

Davies, R. H. Rapacity of Tasmanian fish. Tasmanian Journ. Nat. Sci., 1845, **2**, 311-312.

Add. 1845.1

Davies, William [Lecture on the fossil fishes in the British Museum] Proc. Geol. Assoc. London, 1877, **5**, 106-108.

Add. 1877.1

Davila, Pedro Francisco [—1785] Catalogue systematique des curiosités de la nature . . . du cabinet de M. Davila [compiled by P. F. Davila & J. B. S. de Romé de Lisle] 3 vols. Paris, 1767. 8°.

Add. 1767.1

Jaws of ray and other fragments.

Davis, James William. On a stratum of shale, containing fish remains, in the Lower Coal Measures. Proc. Yorkshire Geol. Soc., 1871-1877 (1879), **6**, 127-137.

Add. 1879.1

— On *Heterolepidotus grandis*, a fossil fish from the Lias. Journ. Linn. Soc. (Zool.), 1885, **18**, 293-298.

Add. 1885.1

H. grandis, n. sp. from Lyme Regis, a synonym of *Osteorachis macrocephalus* Egerton.

— Catalogue of the collection of fossil fishes in the Science and Art Museum, Dublin. 1888. 20 p. 8°.

Add. 1888.1

— On fossil fish of the West Riding coal-field. Rept. Brit. Assoc. Adv. Sci., 1890, 822-823.

Add. 1890.1

— Fossil fishes of the Chalk. Trans. Leeds Geol. Assoc., 1890-91, **6**, 9-12.

Add. 1891.1

Davy, John. Observations on the torpedo, with an account of some additional experiments on its electricity. *Philos. Mag.*, 1835, 3. ser. 6, 57.

Add. 1835.1

Abstract of 1834.1

— On the temperature of some fishes of the genus *Thynnus*. *Philos. Mag.*, 1835, 3. ser. 6, 375. Add. 1835.2

Abstract of 1835.1

— The angler and his friend or piscatory colloquies and fishing excursions. London, 1855. 306 p.

Add. 1855.1

Contains notes on habits of fishes.

Dawson, George. Pleasures of angling with rod and reel for trout and salmon. New York, 1876. 264 p. illust. 12°.

Add. 1876.1

— Angling talks; being the winter talks on summer pastimes, contributed to *Forest and Stream*. New York, 1883. 78 p. 12°.

Add. 1883.1

Dawson, (Sir) John William [1820–1899] For biography and list of works see *Anthrop.*, Paris, 1899, 10, 735. — *Bull. Soc. Belge Géol.*, Bruxelles, 1899, (*Proc.-Verb.*), 255–256. — *Geol. Mag.*, 1899, 6, 575–576. — *Journ. Geol.*, Chicago, 1899, 727–736. — *Ottawa Naturalist*, 1899, 13, 270–274, 280–315. — *Science*, 1899, 10, 905–910. — *Amer. Geologist*, 1900, 26, 1–48. — *Bull. Amer. Geol. Soc.*, 1900, 550–580. — *Amer. Journ. Sci.*, 1900, 9, 82–84. — *Geogr. Jahrbuch.*, 1900, 22, 439. — *Quart. Journ. Geol. Soc.*, 1900, 56, liv–lv. — *Mem. & Proc. Manchester Lit. Phil. Soc.*, 1900, 44, xxxiii–xxxv. — *Nat. Canad.*, 1900, 27, 28–29. — *Nature*, 1899–1900, 61, 80–81. — *Scott. Geog. Mag.*, 1900, 16, 29–30. — *Term. Közl.*, 1900, 32, 691–692. — *Canad. Rec. Sci.*, 1902, 8, 137–149.

— A week in Gaspé. *Canadian Natural. & Geol.*, 1858, 3, 321–331.

Add. 1858.1

— Note on a shark and ray obtained at Little Metis, on the lower St. Lawrence. *Canadian Rec. Sci.*, 1891, 4, 303–309.

Add. 1891.1

— Geological notes. 2. The most ancient fishes. *Canad. Rec. Sci.*, 1893, 5, 386–393.

Add. 1893.1

Dax, Louis. Nouveaux souvenirs de chasse et de pêche dans le midi de la France. Paris, 1860. 288 p. fig. 12°.

Add. 1860.1

Day, Artemas L. The osseous system of *Ophiocephalus striatus* Bloch. *Philippine Journ. Sci.*, 1914, 9, sect. D, 19–55. 19 pls. 7 figs. Add. 1914.1

— Two new cyprinoid fishes of the genus *Barbus* from lake Manquao, Palawan, P. I. *Philippine Journ. Sci.*, 1914, 9, sect. D, 187–193. pl. Add. 1914.2

Barbus bantolanensis and *B. manguaoensis*, n. sp.

Day, Francis [1829–1889] The land of the Permauls, or Cochin, its past and its present. Madras, 1863. x, 577, xxxvii p. 8°.

Add. 1863.1

Fish and fishing, p. 487–509. Habits of *Barbus*, p. 502.

— Notes on the line and herring fisheries of the north-east of Scotland. 1882. 12°.

Add. 1882.1

— The fisheries of India. *Journ. Soc. Arts*, 1883, 609–628. Reprint in *Rept. U. S. Fish. Comm.* 1883 (1885), 383–413.

Add. 1885.1

Brief notes on oral gestation in some Indian Siluridæ. See Day, F., 1873.4.

— Some fishes of the district. *Trans. Nat. Hist. Soc. Burton-on-Trent.*, 1897, 3, 111–117. Add. 1897.1

Day, Francis, Lankester, E. R., & Hamilton, Edward. See **Lankester, Day, & Hamilton.**

Day, G. Morland. Trout and grayling. *Trans. Nat. Hist. Soc. Burton-on-Trent.*, 1892, 2, 58–69. Add. 1892.1

Dean, Bashford [1867–] Contribution to the Devonian fish fauna of Ohio. *Ann. N. Y. Acad.*, 1899–1900, 12, 687.

Add. 1899.1

— A fish out of water [*Protopterus annectens*] the second living specimen of a lung fish ever brought to this country. *Scient. Amer. Suppl.*, 1913, 75, 52. 5 figs.

Add. 1913.1

— A record sunfish (10 feet long, 11 feet vertical) *Amer. Mus. Journal*, 1913, 13, 370–371. fig. Add. 1913.2

Debierre, Charles. Sur l'appareil hyoidien considéré dans la série des vertébrés. L'arc mandibulaire et l'arc hyoidien. *Bull. Soc. Zool. France*, 1885, 10, 487–546. 48 figs.

Add. 1885.1

Poissons, p. 490–495. 7 figs.

Deecke, J. E. W. Ueber zwei Fische aus den Angulatuskalken des Unter-Elsass. *Mittheil. Comm. Geol. Landes-*

Unters. Elsass-Lothringen, Strassburg, 1888, **1**, 11 p. pl. Add. 1888.1

Describes *Heterolepidotus angulati* and *Dapedius cycloides* from Lias.

Deere, Henry Vietz. The *Leptocephalus morissii* Pennant, taken at Slapton, near Dartmouth, Devonshire, on April 29, 1833. Mag. Nat. Hist., 1833, **6**, 530-532. Add. 1833.1

Degland, C. D. Notice sur les labres d'Europe. Mém. Soc. Lille, 1838, **3**, 108. — Rev. Zool., 1839, 93. Add. 1839.1

Delage, Yves [1854-1919]. Capture d'un *Luvarus imperialis* Rafinesque sur la côte du Finistère. C. R. Acad. Sci. Paris, 1914, **159**, 223. Add. 1914.1

Delarbre, A. Essai zoologique sur l'Auvergne, ou histoire naturelle des animaux sauvages quadrupèdes, et oiseaux indigènes; de ceux que ne sont que passagers ou qui paraissent rarement, et des poissons et amphibiens, observés dans cette province. Paris, 1798. 348 p. 8°. Add. 1798.1

Delezenne, C. Action du sérum d'anguille et des extraits d'organes sur la coagulation du sang. Formation d'une substance anticoagulante par circulation artificielle de sérum d'anguille ou d'extraits d'organes à travers le foie. Arch. Physiol., 1897, **9**, 646-660. — C. R. Mém. Soc. Biol. Paris, 1897, **49**, 42-43. Add. 1897.1

Delfin, F. T. For memorial notice see Porter, C. E., 1904.2, 1905.2.

Delfortrie, Eugène. Les sparoides du Tertiaire Aquitainien, etc. Act. Soc. Linn. Bordeaux, 1873, **29**, 83-86. pl. Add. 1873.1

Delsman, H. C. Ist das Hirnbläschen des Amphioxus dem Gehirn der Kranioten homolog? Anat. Anz., 1913, **44**, 481-497. 10 figs. Add. 1913.1

— Der Ursprung der Vertebraten. Eine neue Theorie. Mitteil. Zool. Stat. Neapel, 1913, **20**, 647-710. 9 figs. — Zool. Anz., 1913, **41**, 175-181. 2 figs. Add. 1913.2

— Mededeeling over onderzoekingen aan haringschubben. Tijdschr. Nederl. Dierk. Vereen., 1914, 2. ser. **13**, iv. Add. 1914.1

— Ueber das Wachstum von Nordseehering und Zuiderseehering nach Un-

tersuchungen an den Schuppen. Rapp. Verhand. Rijksinst. Vischerijonderzoek, 1914, **1**, 133-196. pl. Add. 1914.2

— Zalm, schotje en forel (Lachs, Seeforelle und Forelle) Med. Vissch. 1914, **21**, 110-118. Add. 1914.3

Demandt, E. Die Fischerei der Samoaner. Eine Zusammenstellung der bekanntesten Methoden des Fanges der Seetiere bei den Eingeborenen. Im Anhang: Die samoanischen und zoologischen Namen der Seetiere. Mitth. Mus. Volkerkunde, Hamburg, 1912 (1913), **3**, 1-142. 7 pls. 24 text-figs. (In Jahrb. Hamb. Wiss. Anstalten, 1912 (1913), **30**, 10 Beiheft) Add. 1913.1

Exhaustive treatise on fishing with hooks, nets, baskets, etc.

Deml, Josef. Auszüge aus einem Fischereibuche des Salzburger Domkapitals. (In Festgabe des Fischereivereins für die Provinz Brandenburg. Neudamm, 1911, p. 110-116.) Add. 1911.1

— Bayerische Fischerei-Regesten aus dem Ammergebiet. Sonderabdr. Arch. Zeitschr., München, 1913, n. s. **19**, 221-278. Add. 1913.1

For review of this article see Schotte, W., 1913.1

Dendy, A. The function of Reissner's fiber and the ependymal groove. Nature, 1909, **82**. Add. 1909.1

Deniker, J. Bibliographie des travaux scientifiques (sciences mathématiques, physiques et naturelles) publiés par les sociétés savantes de la France depuis l'origine jusqu'en 1888. Paris, 1916. 607 p. 4°. Add. 1916.1

Vol. I (Ain-Orne), all published at this date.

Denil, G. Les échelles à poissons et leur application aux barrages de Meuse et d'Ourthe. Ann. Trav. Publ. Bruxelles, 1909. 152 p. 6 pls. & 103 figs. Add. 1909.1

— La genèse d'une échelle à poisson nouvelle. Bull. Pop. Piscicult., 1909, no. 9, 155-183. Add. 1909.2

Denis, W. Metabolism studies on cold-blooded animals. II. The blood and urine of fish. Jour. Biol. Chem., 1913, **16**, 389-393. Add. 1913.1

— Note on the tolerance shown by elasmobranch fish toward certain nephrotoxic agents. Journ. Biol. Chem., 1913, **16**, 395-398. Add. 1913.2

Dennis, Oregon Milton. Some reasons for failure of fish protective legislation and some suggested remedies (in Proc. 4. Intern. Fish. Cong., Washington, 1908) Bull. U. S. Bur. Fish. 1908 (1910), 28, part 1, 187-192.

Add. 1910.1

Denny, H. Sketch of the natural history of Leeds and its vicinity for twenty miles. Ann. Nat. Hist., 1840, 6, 382-396.

Add. 1840.1

Pisces, p. 392-394.

De Nyse, W. I. The drum-fish. Bull. N. Y. Zool. Soc., 1907, 344-345.

Add. 1907.1

Deseille, E. [1835-] Boulogne port and station sea fisheries in 1882. A statistical survey drawn up . . . by E. Deseille. Translated from the French by V. G. Vaillant. (In Great Intern. Fisheries Exhib. Lit. London, 1883) Boulogne-sur-Mer, 1883. 42 p. 8°.

Add. 1883.1

Desir, — Note sur l'acanthocéphale du maquereau commun (*Scomber scombrus*). Arch. Méd. Comp. (Roger), Paris, 1843, 1, 309-311. pl.

Add. 1843.1

Desports, J. B. P. Histoire des maladies de S. Domingue. 3 vols. Paris, 1770.

Add. 1770.1

Ciguatera or poisoning by eating fish, I, p. 108-109.

Desvaux, Auguste Nicaise. Sur les poissons propres au département de la Loire-Inférieure et aux côtes qui la bordent. Ann. Soc. Roy. Sci. Académ. Nantes, 1843, 2. sér. 4, (14), 154.

Add. 1843.1

Complete reference for Desvaux, A. N., 1843.1.

— Essai d'ichthyologie des côtes océaniques et de l'intérieur de [l'ouest de] la France, ou diagnose [d'un grand nombre] des poissons observés. Mém. Soc. Nat. Agric., Angers, 1851, 2. sér. 2, 210. 2 pls.

Add. 1851.1

Complete reference for Desvaux, A. N., 1851.1.

De Vis, Charles W. On three new fishes from Queensland. New Zealand Journ. Sci., 1882, 1, 274.

Add. 1882.1

Brief preliminary reference to fishes described in De Vis, C. W., 1883.3.

— *Ceratodus forsteri* post-Pliocene. Proc. Roy. Soc. Queensland, 1884, 1, 40-43.

Add. 1884.1

— On a new form of the genus *Therapon*. Proc. Roy. Soc. Queensland, 1884, 1, 55-56.

Add. 1884.2

— On new fish from Moreton bay. Proc. Roy. Soc. Queensland, 1884, 1, 144-147.

Add. 1884.3

The following new species are described: — *Chærops venustus*, *Cossyphus aurifer*, *Genyoroge amabilis*, *G. regia*, *Lethrinus imperialis*, *Salarias galeatus*, *Serranus geometricus* and *S. viridipinnis*.

— Description of a species of *Eleotris* from Rockhampton. Proc. Roy. Soc. Queensland, 1886, 2, 35-38.

Add. 1886.1

— Notice of a fish apparently undescribed. Proc. Roy. Soc. Queensland, 1886, 2, 144-145.

Add. 1886.2

— On a lizard and three species of *Salarias*, etc. Proc. Roy. Soc. Queensland, 1886, 2, 56-61.

Add. 1886.3

Deyrolle-Guillou, — Les ennemis de l'huitre. Naturaliste, Paris, 1910, 32. année, 56-57; 70-72. 2 figs.

Add. 1910.1

Dewar, G. A. B. Wild life in Hampshire highlands. London, 1899. 7 pls. 8°.

Add. 1899.1

Angling in Hampshire, p. 94-136.

Dick, Thomas Lauder. Account of the worm with which the sticleback is infested. Ann. Phil., London, 1816, 7, 106-109. pl.

Add. 1816.1

Dietz, P. A. Beiträge zur Kenntniss der Kiefer- und Kiemenbogenmuskulatur der Teleostier. I. Die Kiefer und Kiemenbogenmuskeln der Acanthopterygier. Mitt. Zool. Stat. Neapel, 1914, 22, 99-162. 45 figs.

Add. 1914.1

Dieulafé, Léon. Morphology and embryology of the nasal fossae of vertebrates. Translated from French by H. W. Loeb. St. Louis, 1906.

Add. 1906.1

Reprinted from Ann. Otol. Rhin. Laryngol. (March, June & Sept.), 1906.

See also Dieulafé, L., 1904.1

Dillwyn, L. W. On the capture of a specimen of *Labrus maculatus* Bl. in Swansea bay. Proc. Zool. Soc. London, 1830-31 (1831), 35.

Add. 1831.1

Dimock, A. W. The book of the tarpon. New York, 1911. 256 p. illust.

Add. 1911.1

Dissard, J. A., & Noé, Joseph. Sédentarité des poissons venimeux. C. R. Mém. Soc. Biol. Paris, 1894, 10. ser. 1 (46), 86-87.

Add. 1894.1

Distant, W. L. Butterflies eaten by bream. *Zoologist*, 1914, 4. ser. **18**, 320. Add. 1914.1

— Notes by an angler. *Zoologist*, 1914, 4. ser. **18**, 319–320; 359–360. Add. 1914.2

Habits of gudgeon, bream, and carp.

Dittmer, R. (editor) Deutscher Seefischerei-Almanach, herausgegeben vom deutschen Seefischerei-Verein, bearbeitet von R. Dittmer. Hannover, 1909. 910 p. 16 pls. 8°. Add. 1909.1

Dixon, Frederick [1799–1849] The geology of Sussex; or the geology and fossils of . . . Sussex . . . New [second] edition. Revised . . . by T. R. Jones. Brighton, 1878. xxiv, 469 p. 64 pls. map. illust. 4°. Add. 1878.1

— Notes on the fishes of the Chalk. Revised by Sir P. Egerton and E. T. Newton. (In his *The Geology of Sussex*, etc. Brighton, 1878. 4°.) Add. 1878.2

Doderlein, P. Rapporto della Commissione inviata a Siracusa . . . per acclimarvi il pesce Gurami. Palermo, 1867. 68 p. 2 pls. Add. 1867.1

Doell, — Festschrift den Mitgliedern des deutschen Fischereirates bei seiner Tagung in Metz vom 3–7 Juni, 1913, gewidmet vom Lothringer Fischereiverein in Metz. Metz, 1913, 39 p. Add. 1913.1

Doesschate, G. ten. De eigenschappen der endolympe van beenvisschen [Die Eigenschaften der Endolympe der Knochenfische] Onderzoekingen Physiol. Laboratorium, Utrecht, 1914, 5. ser. **14**, 1–74. figs. Add. 1914.1

Doflein, Franz J. Th. Studien zur Naturgeschichte der Protozoan. III. Ueber Myxosporidien. *Zool. Jahrb., Anat. Abth.*, 1898, **11**, 281–350. 7 pls. 20 figs. Add. 1898.1

Parasites on fishes.

— Fortschritte auf dem Gebiete der Myxosporidienkunde. *Zool. Centralb.*, 1899, **6**, 361–379. Add. 1899.1

Epidemics of fishes due to Myxosporidia.

Dohrn, Anton. For memorial notice see Dean, B., 1910.1.

— The zoological station at Naples, Italy. *Bull. U. S. Fish Comm.* 1883, **3**, 433–435. Add. 1883.1

— Studien zur Urgeschichte des Wirbelthierkörpers. XI. Spritzlochkieme, Kiemendeckelkieme der Ganoïden, Pseudobranchii der Teleostier. *Mittheil. Zool. Stat. Neapel*, 1886–87 (1886), **7**, 128–176. 2 pls. Add. 1886.1

To replace Dohrn, A., 1882.2, xi, which is erroneous.

Dohrn, W. L. H. Fischereiprodukte und Wasserthiere. Intern. Fischerei-Ausstell. Berlin, 1880. Amtliche Berichte, iv. Berlin, 1881. 8°. Add. 1881.1

Dollfus, Auguste [1840–1869] La faune Kimmérienne du Cap de la Hève, etc. Paris, 1863. vii, 102 p. 18 pls. 4°. Add. 1863.1

Dollo, Louis [1857–] L'œil pinéal et les poissons placodermes du Vieux Grès Rouge. *Bull. Soc. Belge Géol. (Proc.-Verb.)*, 1887, 57–58. Add. 1887.1

— Sur le *Lepidosteus suessoniensis*. *Bull. Soc. Belge Géol. (Proc.-Verb.)* 1890, **4**, 242–243. Add. 1890.1

— La vie au sein des mers. La faune marine et les grandes profondeurs, &c. *Bib. Scien. Contemp.*, Paris, 1891. 304 p. illust. 8°. Add. 1891.1

— Nouvelle note sur les poissons de la Craie phosphatée. *Bull. Soc. Belge Géol. (Proc.-Verb.)*, 1893, 93. Add. 1893.1

Records *Protosphyraena ferox* Leidy from Senonian of Mons.

— Sur quelques Requins Carbonifères. *Bull. Soc. Belge Géol. (Proc.-Verb.)*, 1896, 16. Add. 1896.1

Archipterygium of *Ceratodus* and *Pleuranthus* are of independent origin.

Domsma, Martinus. Ontleedkundige beschrijving van eenen Zonne-Visch (Tetraodon) Verhandl. Maatsch. Haarlem, 1770, **12**, 413–422. Abstract in *Comm. de Rebus*, **18**, 593. Add. 1770.1

Donnadieu, A. L. [Communication sur le développement de la ligule de la tanche] *Lyon Méd.*, 1877, **24**, 563–567. Add. 1870.1

Doolittle, Justus. Social life of the Chinese. 2 vols. New York, 1865. Add. 1865.1

Vol. i, raising fish in ponds, p. 54–55; fishing with the cormorant, p. 55–57.

Doran, J. I. Our fishery rights in the north Atlantic. Philadelphia, 1888. 67 p. Add. 1888.1

Dorn, Richard. A note on the purring gourami. Copeia, 1914, no. 4, 1-2. Add. 1914.1

Doublier, — Prodrome d'histoire naturelle du département du Var. Première partie. Draguignan, 1853. 490 p. 8°. Add. 1853.1
Ichthyologie, 18 p.

Doughty, J., & Doughty, T. The cabinet of natural history and American rural sports. 2 vols. Philadelphia, 1830-32. 300, 294 p. pls. 4°. Add. 1830.1

Contains colored lithographic plates of fish.

Dow, J. M. Notice of a viviparous fish (*Anableps dowi*) from the bay of La Union, state of San Salvador. Ann. Nat. Hist. 1861, 3. ser. 7, 420. Add. 1861.1

Downing, S. W. Some of the difficulties encountered in collecting pike-perch eggs. Trans. Amer. Fisheries Soc. 1910 (1911), 277-282. Add. 1911.1

Drake, Henry C., & Sheppard, Thomas. Classified list of organic remains from the rocks of the East Riding of Yorkshire. Proc. Yorkshire Geol. Soc., 1910, n. s. 17, 4-71. Add. 1910.1

Dresslar, F. B., & Bicknell, E. P. See **Bicknell & Dresslar.**

Drew, G. Harold. Notes on parasitic and other diseases of fish. Parasitology, Cambridge, 1909, 2, 193-201. Add. 1909.1

Drew, G. H., & Gamble, F. W. See **Gamble & Drew.**

Drouin de Bouville, Raoul de. Les maladies des poissons d'eau douce d'Europe, d'après les travaux des divers ichthyopathologistes et le traité du Prof. Hofer. I. Infections générales de l'organisme. 2nd éd. Paris, 1909. 7 pls. 27 illust. 8°. Add. 1909.1

— L'importance de la race en salmoniculture. C. R. 9. Congrès. Intern. Zool., Monaco, 1913. 692-696. Add. 1913.1

Dryander, Jonas. Catalogus bibliothecæ historico-naturalis Josephi Banks, Baroneti, etc. 5 vols. Londini, 1796-1800. 8°. Add. 1796.1

Vol. I, Scriptores generales. Vol. II, Zoology.

Dubalen, P. E. Notes ichthyologiques. Proc.-Verb. Soc. Linn. Bordeaux, 1913, 67, 74-76. Add. 1913.1

— Nouvelle espèce de poisson d'eau douce (*Idus stagnalis*) Proc.-Verb. Soc. Linn. Bordeaux, 1913, 67, 77-79. Add. 1913.2

Dubard, — Un cas de tuberculose chez les poissons (tuberculose cyprine). Province Méd., Lyon, 1897, 11, 235. Add. 1897.1

Dubois, R. Procédé d'embaumement et de momification à l'air libre. 4. Congr. Internat. Zool., Monaco, 1913 (1914), 160-164. Add. 1914.1

Preservation of fishes for exhibition.

Du Bois-Reymond, Emil Heinrich [1818-1896] Quæ apud veteres de piscibus electricis. Inaug. Diss., Berlin, 1843. Add. 1843.1

— On animal electricity: being an extract [by J. Müller] of the discoveries of E. Du Bois-Reymond. [Edited by H. Burne Jones] London, 1852. xiii, 214 p. Add. 1852.1

— Gesammelte Abhandlungen zur allgemeinen Muskel- und Nervenphysik. 2 vols. Leipzig, 1875. 398, 753 p. Add. 1875.1

i. Zitterfische, p. 213-227.

ii. Elektrische Fische, p. 601-735.

— Aus den Llanos! Anzeige und Necrolog. Deutsche Rundschau, 1879, 18, 390-399. Add. 1879.1

Review and résumé of Carl Sachs' book "Aus den Llanos," Add. 1879.1. See also other references under Sachs and Du Bois-Reymond.

— Bemerkungen über einige neuere Versuche zu Torpedo. Archiv. Anat. Physiol. (Physiol. Abth.), 1889, 316-344. Add. 1889.1

Du Bois-Reymond, René. Physiologie der Bewegung (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, 3, Hälfte 1, Theil 1, p. 1-248. 83 figs. Jena, 1914) Add. 1914.1

Schwimmen der Fische, p. 166-185. 2 figs.

Duboscq, O., & Lebailly, C. Les spirochètes des poissons des mers. Arch. Zool. Expér. 1912, 10. — C. R. Acad. Sci. Paris, 1912, 154. Add. 1912.1

— Sur les spirochètes des poissons (Deuxième note) Arch. Zool. Expér. Gén. Paris, 1913, 52, 9-24. 7 text-figs. Add. 1913.1

Ducceschi, V. Una legge del movimento animale. *Zeitschr. Allgem. Physiol.*, 1903, **2**, 482-501. Add. 1903.1

Thirty fishes studied, p. 486-493.

Duerden, J. E. Beaumaris shark in Dublin Bay. *Irish Naturalist*, 1894, **3**, 262. Add. 1894.1

Duge, F., Henking, H., & Wilhelm, O. Bericht über die Internationale Fischerei-Ausstellung in St. Petersburg 1902. Berlin, 1902. fig. map. Add. 1902.1

Dugmore, A. R. Nature and the camera. New York, 1902. 126 p. illust. Add. 1902.1

Handling and photographing fish, p. 103-113.

Dujardin, Felix. [Observations nouvelles sur les zoospermes . . . de la carpe] *Proc. Verb. Soc. Philom. Paris*, 1838, 7-8. Add. 1838.1

Duke, R. T. W. A four-pound carp lives eight hours out of water by being packed in wet moss. *Bull. U. S. Fish Comm.*, 1884, **4**, 16. Add. 1884.1

Duméril, Auguste. Considérations sommaires sur l'intérêt que présente l'observation des actes accomplis par les animaux à des époques périodiques et sur l'utilité de la publication des faunes locales. *Ann. Soc. Linn. Maine-et-Loire, Angers*, 1869, 11. ann., 181. Add. 1869.1

Migrations et frai des poissons de mer en eau douce.

Duméril, C. Mémoire pour ouvrir à l'histoire de la respiration des poissons. *Mag. Encycl.*, Paris, 1807, **4**, 45. Add. 1807.1

Dunbar-Brunton, J. The poison-bearing fishes, *Trachinus draco* and *Scorpena strophæa*; the effects of the poison on man and animals, and its nature. *Lancet*, 1896, **2**, 600-602. Add. 1896.1

Duncker, Georg. Description of a new species of *Hippocampus*. *Rec. Indian Mus. Calcutta*, 1914, **10**, 295. Add. 1914.1

— Generalindex zu Franz Steindachners Ichthyologischen Mitteilungen, Notizen und Beiträgen. *Mitth. Naturhist. Mus. Hamburg*, 1914, 32. Jahrg., 285-352. Add. 1914.2

Dunn, Matthias. Food of sea fishes. *Zoologist*, 1885, 3. ser. **9**, 236-237. Add. 1885.1

— Habits of the lesser weever [*Trachinus vipera*] *Zoologist*, 1885, 3. ser. **9**, 353. Add. 1885.2

— Ova of the ling [*Molva vulgaris*] *Zoologist*, 1885, 3. ser. **9**, 237. Add. 1885.3

— Some facts in the life history of the pollack, as seen off the coast of Cornwall. *Rept. Cornwall Polyt. Soc.*, 1885, 74-84. Add. 1885.4

— *Torpedo marmorata* at Mevagissey. *Zoologist*, 1885, 3. ser. **9**, 353. Add. 1885.5

— Some habits of the picked dogs, herrings and pilchards on the coasts of Devon and Cornwall. *Rept. Cornwall Polyt. Soc.*, 1886, 155-170. Add. 1886.1

— Notes on the skates and rays of Cornwall. *Rept. Cornwall Polyt. Soc.*, 1888, 97-102. Add. 1888.1

— Remarks in connection with the laws, capture, and natural history of the herring and pilchard. Also a supposed hybrid between the pilchard and the herring. *Ann. Rept. Roy. Cornwall Polyt. Soc., Falmouth*, 1888, no. 55. 24 p. 8°. Add. 1888.2

— Facts in the life history of the Motella and some flat fishes. *Rept. Cornwall Polyt. Soc.*, 1889, 93-99. Add. 1889.1

— The decline of some of our fisheries on the Cornish coast, its cause and cure. *Rept. Cornwall Polyt. Soc.*, 1890, 72-82. Add. 1890.1

— The wants of our fisheries. *Rept. Cornwall Polyt. Soc.*, 1891, 77-87. Add. 1891.1

— The migrations and habits of the pilchard. *Rept. Cornwall Polyt. Soc.*, 1892, 75-95. Add. 1892.1

— The migrations and other habits of the herring on the coasts of Devon and Cornwall. *Rept. Cornwall Polyt. Soc.*, 1894, 58-72. Add. 1894.1

— The seven senses of fishes. *Contemp. Rev.*, London, 1899, **76**, 199-219. Add. 1899.1

Electric and magnetic dermal senses.

— Relative life in the sea. *Rept. Cornwall Polyt. Soc.*, 1900, 63-64. Add. 1900.1

Dupré, Paul. L'œuvre des sociétés de pêche et de pisciculture. "La Gaule" de Vizille. Bull. Soc. Cent. Aquicult. Pêche, Paris, 1912, **24**, 6-10.

Add. 1912.1

D'Urban, W. S. M. Does the flying fish fly? Zoologist, 1881, 3. ser. **5**, 146-147.

Add. 1881.1

Durnford, R. The fishing diary, 1809-1819. London, 1911. 124 p. illust. 8°.

Add. 1911.1

Duvernoy, G., & Cuvier, G. See Cuvier & Duvernoy.

Dyche, L. L. Notes on the new Kansas fish hatchery and the first year's output. Trans. Amer. Fisheries Soc., 1914, 5-12.

Add. 1914.1

—— Ponds, pond fish, and pond fish culture. Dept. Fish & Game, Kansas, 1914. 130 p. figs.

Add. 1914.2

First edition, 1910. 36 p.; figs.; second edition, 1911. 55 p. figs.

E

Earl, George Windsor. The eastern seas, or voyages and adventures in the Indian archipelago in 1832-34, etc. London, 1837. Add. 1837.1

Fishing with baskets, p. 37; with hooks, p. 94-95; rattles to attract fish, p. 195-196; fishing for *Periophthalmus* with a spiked plank.

Earll, R. Edward. Catalogue of the apparatus for the capture of fish exhibited by the U. S. National Museum. Washington, 1883, 105 p. Add. 1883.1

Catalogue J. of the exhibit made by the United States National Museum at the Great International Fisheries Exhibition, London, 1883.

— Catalogue of the fish-cultural exhibit of the U. S. National Museum. Washington, 1883. 94 p. Add. 1883.2

Catalogue L. of the exhibit made by the United States National Museum at the Great International Fisheries Exhibition, London, 1883.

— The mullet fishery (In The fisheries and fishery industries of the United States, edited by George Brown Goode, sect. 5, vol. i, 553-582. pl. 1889) Add. 1889.1

Eastman, Charles Rochester (1868-1918) For memorial notice, See Dean, Bashford, Amer. Mus. Journ., 1918, 18, 506-507. Also Science, 1919, n. s. 49, 139-141.

— Brain structures of fossil fishes from the Caney shales [Abstract] Bull. Geol. Soc. Amer., 1913, 24, 119-120. Add. 1913.1

— Fossil fishes (In Eastman, C. R., Gregory, W. K., & Matthew, W. D. Recent progress in vertebrate paleontology. Science, 1916, n. s. 43, 103-110.) Add. 1916.1

— Olden time knowledge of Hippocampus. Rept. Smithson. Inst., 1915 (1916), 349-357. 4 pls. Add. 1916.2

— The Reversus, a fishing tale of Christopher Columbus. Scient. Monthly, 1916, 3, 31-40. 5 figs. — Americana, 1916, 11, 438-446. — Bull. L'Union Panaméricaine, 1917, 12, 70-74. pl. Add. 1916.3

— Dentition of Hydrocyon and its supposed fossil allies. Bull. Amer. Mus. Nat. Hist., 1917, 37, art. 26, 757-760. 3 text figs. 4 pls. Add. 1917.1

Onchosaurus from the Cretaceous recognized as ancestral form of Characins.

— Fish names, ancient and modern, and early illustrations of fishes. Science, 1917, n. s. 46, no. 1184, 228-231. Add. 1917.2

— Fossil fishes in the collection of the United States National Museum. Proc. U. S. Nat. Mus., 1917, 52, 235-304. 23 pls. & 9 figs. Add. 1917.3

— The Hippocampus in ancient art. Nature, 1917, 99, 385. fig. Add. 1917.4

Eck, H. Ueber die Formationen des bunten Sandsteins und des Muschelkalks in Oberschlesien und ihre Versteinerungen. Berlin, 1865. vii, 148 p. 1 tab. 2 pls. Add. 1865.1

— Rüdersdorf und Umgegend, eine geognostische Monographie. (In Abhandlung zur Geologischen Specialkarte von Preussen und den thüringischen Staaten. Berlin, 1872, 1, no. 1.) Add. 1872.1

Ganoiden-Schuppen und Zähne des Muschelkalks.

Eckstein, K. Fischaberglauben. Mitth. Fischerei Ver. Prov. Brandenburg, 1911, 3, Heft 2, 47-48. Add. 1911.1

— Die Fischer zu Driesen. Mitth. Fischerei Ver. Prov. Brandenburg, 1911, 3, Hefte 19-22, 309- Add. 1911.2

— Jahresbericht über die Fischereiliteratur. 1. Jahrgang, das Jahr 1911, Neudamm, 1912. Add. 1912.1

— Jahresbericht über die Fischereiliteratur, umfassend die Veröffentlichungen auf dem Gebiete der europäischen Binnenfischerei. 2. Jahrg., das Jahr 1912. Neudamm, 1913. 496 p. Add. 1913.1

Edge-Partington, J. Floats for alluring salmon, from the north end of

Edge-Partington, J.

Vancouver island. *Journ. Anthropol. Inst. Gt. Britain & Ireland*. London, 1900, **30** (n. s. **3**), no. 57. fig.

Add. 1900.1

Edge-Partington, James, & Heape, Charles. An album of the weapons, tools, ornaments, articles of dress of the natives of the Pacific Ocean. 3 vols. Manchester, 1890-98. obl. fol.

Add. 1890.1

Figures of fish hooks, spears, traps, nets, kites, lures, shark rattles and nooses, etc.

Edge-Partington, T. W. Kite-fishing by the salt-water natives of Mala or Malaita, British Solomon Islands. *Man*, Monthly Rec. Anthropol. Sci., 1912, **12**, no. 4, 9-11. 4 figs.

Add. 1912.1

Edinger, Ludwig. Ueber die Schleimhaut des Fischdarmes, nebst Bemerkungen zur Phylogenie der Drüsen des Darmrohres. *Arch. Mikr. Anat.*, 1887, **13**, 651-692. 2 pls.

Add. 1887.1

Edington, Alexander. An investigation into the nature of the organisms present in "red" cod, and as to the cause of the red coloration. 6. *Ann. Rept. Fish. Board Scotland*, 1888, pt. 3, 207-214.

Add. 1888.1

— On certain pathological conditions occurring in fish. *Journ. Comp. Path. Therap.*, 1889, **2**, 235-240.

Add. 1889.1

— On the Saprolegnia of salmon disease and allied forms. 7. *Ann. Rept. Fish. Board Scotland*, 1889, pt. 3, 368-382.

Add. 1889.2

Edmonston, Arthur. A view of the . . . Zetland Islands; including their . . . natural history, etc. 2 vols. Edinburgh, 1809.

Add. 1809.1

Fisheries of Zetland, vol. I, 230-293. Fishes of Zetland, vol. II, 302-306.

— Observations on the nature and extent of the cod fishery, carried on off the coasts of the Zetland and Orkney islands. Edinburgh, 1820. 38 p.

Add. 1820.1

i. Fisheries — Shetland Islands. ii. Fisheries — Orkney Islands. iii. Cod-fisheries.

Edwards, George. An observation made by him in opticks. *Phil. Trans. Roy. Soc.*, 1763, **53**, 229-230.

Add. 1763.1

On the vision of fishes.

Edwards, Henri Milne [1800-1885] For a biographical sketch see Perrier,

Edmond. *Bull. Nouv. Arch. Mus. Hist. Nat.*, Paris, 1900. 4. ser. **2**, xxix-lxiii. *Necrologie* (Orations delivered at his funeral) *Ann. Sci. Nat.*, 1885, 6. ser. **19**. See also Berthelot in *Ann. Sci. Nat.*, 1892, **13**, 1-30; and in *Rept. Smithson. Instit.*, 1893, 709-727.

Edwards, J. Poisoning by fish. *Brit. Med. Journ.*, London, 1884, **1**, 10.

Add. 1884.1

Edwards, Thomas. For biography see Smiles, S. 1877.1.

Eeckhout, R. A. Schetsen van Java's zuidkust in woord en beeld. 2. *Volksvoedsel en vischvangst. Tijdschr. Ver. Nederl. Zeewezen*, 1905, 4. jaarg., 1-6; 17-20; 33-39. figs.

Add. 1905.1

Ege, R., & Krogh, A. On the relation between the temperature and the respiratory exchange in fishes. *Intern. Rev. Hydrobiol. Leipzig*, 1914, **7**, 48-55.

Add. 1914.1

Eglini, Raphael. Von einem vorgeblichen Fischregen. *Wittenb. Wochenbl.*, 1771, **4**, 329, 370.

Add. 1771.1

— Ursache des Zuges mancher Zugfische, besonders der Hausen. *Neueste Mannichfaltigk.*, Berlin, 1778, **1**, 705.

Add. 1778.1

Ehlers, Ernst Heinrich [1835-] For bibliography see Taschenberg, E. O. W. 1905.1.

Ehrenbaum, Ernst [1861-] Die Frage des Aalbesatzes. *Centralfischerei Vereins Schleswig-Holstein*, 1913, 36. Jahresber., 177-182.

Add. 1913.1

— Die Scholle in der Internationalen Meeresforschung. *Der Fischerbote*, 1913, **5**, 104.

Add. 1913.2

— Ueber die Stör. *Centralfischerei Vereins Schleswig-Holstein, Rendsburg*, 1913, 36. Jahresber., 173-176.

Add. 1913.3

— Untersuchungen über den Aal. *Der Fischerbote*, 1913, **5**, 262. — *Centralfischerei Vereins Schleswig-Holstein*, 1913, 36. Jahresber., 183-191.

Add. 1913.4

— Die Aalfrage. *Centralfischerei Ver. Schleswig-Holstein*, 1914, 37. Jahresber., 159-169. chart.

Add. 1914.1

— The mackerel and the mackerel fishery, biological and fishery-statistical report to the International council for

the investigation of the sea. Rapp. Procès-Verb. Cons. Internat. Explor. Mer. 1914, **18**. 101 p. Add. 1914.2

— Die Makrele als Gegenstand der internationalen Meeresforschung. Verh. Nat. Ver. Hamburg, 1914, 3. ser. **21**, lxxv-lxxvi. Add. 1914.3

— Neue Untersuchungen über den Elbutt. Der Fischerbote, 1914, **6**, 93. Add. 1914.4

— Die Seezunge (*Solea vulgaris* Quensel) in fischereilicher und biologischer Beziehung. Mitth. Naturhist. Mus. Hamburg, 1914, 31. Jahrg., Beih. 2, 367-390. map. Add. 1914.5

— Ueber die Schwankungen in den Erträgen den grossen Seefischereien von Dr. J. Hjort. Der Fischerbote, 1914, **6**, 146. Add. 1914.6

— Ueber Fische von Westafrika, besonders von Kamerun. Der Fischerbote, 1914, **6**, 15; 53; 106; 193; 254; 289; 337; 401. Add. 1914.7

Ehrenberg, Christian Gottfried. Symbolæ physicæ seu icones et descriptiones piscium qui ex itinere per Africam borealem et Asiam occidentalem Friderici Guilielmi Hemprich et Christiani Godfredi Ehrenberg medicinæ et chirurgiæ doctorum studio novi aut illustrati redierunt. Percensuit et regis iussu et impensis. Edidit Dr. C. G. Ehrenberg. Decas prima. Berolini, 1828. Add. 1828.1

See also Hemprich, F. G., & Ehrenberg, C. G., 1899.1.

— Sur les infusoires contenues dans une substance d'apparence terreuse que renfermait le canal intestinal d'un poisson de Lima. C. R. Acad. Sci. Paris, 1847, **25**, 365-366. Add. 1847.1

Ehrenberg, —, Brix, —, & Musset — See **Brix, Musset, & Ehrenberg.**

Eichwald, Carl Eduard von [1795-1876] Zoologia specialis quam expositis animalibus tum vivis, tum fossilibus potissimum Rossia, in universam, et Polonia in specie, etc. 3 parts [in 2 vols.] Vilnæ, 1829-31. illust. 8°. Add. 1829.1

Describes Nematosoma, p. 60, synonym of Nerophilus; Benthophilus, p. 77.

— Die Thier- und Pflanzenreste des alten rothen Sandsteins und Bergkalks im Novgorodschen Gouverne-

ment. Bull. Imp. Acad. Sci. St. Petersburg, 1840, **7**, 78-91. Add. 1840.1
Describes Asterolepis, p. 79.

— Die Grauwachenschichten von Liev- und Esthland. Bull. Soc. Imp. Nat. Moscou, 1854, **27** (pt. 1), 3-111. Add. 1854.1

Pterygotus, Thyestes, and Sphagodus.

Eigenmann, Carl H. [1863-] On the genesis of the color-cells of fishes. West Amer. Scientist, 1889, **6**, 61-62. Add. 1889.1

— Description of a fossil species of Sebastodes. Zoe, 1890, **1**, 17. fig. Add. 1890.1

S. rosæ, n. sp., Tertiary at Port Harford, Cal.

— On the egg membranes and micropyle of some osseous fishes. Bull. Mus. Comp. Zool., 1890, **19**, 129-154. 3 pls. Add. 1890.2

— *Cymatogaster aggregatus* Gibbons; a contribution to the ontogeny of viviparous fishes, Bull. U. S. Fish Comm., 1892, **12**, 401-468; 472-478. 26 pls. Add. 1892.1

— The ling on the Pacific slope. Science, 1894, **23**, 136. Add. 1894.1

— On the Amblyopsidæ. Science, 1898, n. s. **7**, 227. Add. 1898.1

— Degeneration in the eyes of the cold-blooded vertebrates of the North American caves. Science, 1900, n. s. **11**, 492-503. Add. 1900.1

— The finding of the Leptocephalus of the American eel. Science, 1901, n. s. **14**, 631. Add. 1901.1

Eigenmann, Carl H., & Beeson, Charles H. The fishes of Indiana and their distribution. Bienn. Rept. Comm. Fisheries & Game, Indiana, 1903-04 (1905), 113-157. Add. 1905.1

Eigenmann, (Mrs.) Rosa Smith. Description of a new species of Euprotomiscus. Proc. Calif. Acad. Sci., 1890, 2. ser. **3**, 35. Add. 1890.1

Eiger, M. Die physiologischen Grundlagen der Elektrokardiographie. Arch. Gesamt. Physiol., 1913, **151**, 1-51. 9 figs. 7 pls. Add. 1913.1

Observations on hearts of carp and pike.

Einarssyn, Biarna. Um Terreneufs og klippfisks-verkun. Rit Pèsz Islenszka Lærdoms-lista Felags., 1783, **3**, 1. Add. 1783.1

Eisig, Hugo. Dient das elektrische Organ dem Torpedo nur als Vertheidigungs- oder auch als Angriffswaffe? Kosmos, Stuttgart, 1883, **13**, 129-130.

Add. 1883.1

— Medusenfressende Fische. Kosmos, Stuttgart, 1884, 8. Jahrg., **14**, 305-306.

Add. 1884.1

— Ueber die Eiablage der Seebarsch (Labrax) und Lippfische (Crenilabrus). Kosmos, Stuttgart, 1884, 8. Jahrg., **14**, 306-309.

Add. 1884.2

— Ueber die Einfluss künstlicher Beleuchtung auf das Verhalten verschiedener Seetiere. Kosmos, Stuttgart, 1884, 8. Jahrg., **14**, 303-304.

Add. 1884.3

Lichia, Mustelus, Scyllium and Torpedo.

The above articles by Eisig, as well as those in Vol. I (1883.1 and 1883.2) are parts of a collection entitled "Biologische Studien, angestellt in der zoologischen Station in Neapel." The other parts of this deal with invertebrates.

Eisler, Robert. Der Fisch als Sexualsymbol. Imago, Leipzig, 1914, **3**, 165-196.

Add. 1914.1

Eismond, Joseph. Zur Ontogenie des Amphioxus. Biol. Centralbl., 1894, **14**, 353-360. fig.

Add. 1894.1

Elder, J. R. The royal fishery companies of the seventeenth century. London & Glasgow, 1912. 142 p. 8°.

Add. 1912.1

Elkington, E. Way, & Hardy, Norman H. See **Hardy & Elkington.**

Ellacombe, H. N. (Rev.) Shakespeare as an angler. London, 1883. 78 p. 16°.

Add. 1883.1

Elliot, Jonathan. Historical sketches of the . . . district of Columbia; with . . . a description of the River Potomac, its fish and wild fowl, &c. Washington, 1830. 554 p. 16°.

Add. 1830.1

Elliott, Charles B. The United States and the northeastern fisheries. A history of the fishery question. Minneapolis, 1887. vii, 144 p. map.

Add. 1887.1

Part I, p. 1-100, historical, — a hasty review of the rise of the fisheries, based largely on Sabine's report, and a statement of the important diplomatic questions arising under the several treaties down to 1887. Part II discusses terms of the Treaty of 1818. In the treatment of Part I after 1850, and in the treatment of Part II, the author made a valuable contribution to the discussion of the fishery

question. The economic and commercial aspects of the fisheries are not touched upon to any extent beyond the range of Sabine's contributions.

Elliott, Henry W. The destruction of the carp by the muskrat (*Fiber zibethicus*) Methods of trapping the rodent. Bull. U. S. Fish Comm. 1884, **4**, 296-297.

Add. 1884.1

— *Quiscalus quiscula aeneus* killing and catching goldfish. Auk, 1890, **7**, 208-209.

Add. 1890.1

Elliott, J. Steele. Some notes on eels (*Anguilla vulgaris*) and eel-catching in Bedfordshire. Zoologist, 1914, 4. ser. **18**, 121-130.

Add. 1914.1

Ellis, Max M. Fishes of Colorado. Univ. Colorado Stud., 1914, **11**, 1-136. 12 pls.

Add. 1914.1

Ellis, William [1794-1872] Polynesian researches during a residence of nearly six years in the South Sea islands, including descriptions of the natural history of the islands, etc. 2 vols. London, 1829-30. 8°.

Add. 1829.1

Vol. I. Fishes, p. 75-79; fishing methods (traps, rafts, poison, hooks, nets, spears, mast), p. 138-150; sharks, p. 165-168, 225-226.

— The same. Another edition. 4 vols. New York, 1853. sm. 8°.

Add. 1853.1

Vol. I. Fishes, p. 70-71, 135-137, 180-181; fishing with nets, harpoons, hooks, etc., p. 115-125; with poisonous plants (hutu and hora), p. 117.

Ellis, W. Hodgson. Relation between the weight and length of brook-trout (In Mayer, A. M., Sport with gun and rod, etc., p. 605-607. New York, 1883.)

Add. 1883.1

Ellis, William W. [115 original water color sketches of mammals, birds, fishes, etc., made during Capt. James Cook's third voyage, 1776-80] Preserved in the library of the British Museum of Natural History.

Add. 1776.1

Elmhirst, Richard. The keeping of young herring alive in captivity. Nature, 1908, **79**, 38.

Add. 1908.1

Elscher, T. H. De ea œconomia parte, quæ circa piscinas versatur. Abhandl. Naturf. Gesellsch. Zurich, [c. 1764], **2**, 219.

Add. 1764.1

Embody, G. C. Fish meal as food for trout. Trans. Amer. Fisheries Soc., 1914, 57-60.

Add. 1914

— The horned dace. *Nature Study Review*, 1914, **10**, 168–174.

Add. 1914.2

Emeljanenko, N. Zur Frage nach der Pigmentierung der Forelle (*Salmo fario* L.) (Text in Russian) *Vešt. Rybopromyšl*, Petrograd, 1913, **28**, 81–91.

Add. 1913.1

Emeljanenko, P. Die Fische des Dniepr-Bassins (Text in Russian) *Vešt. Rybopromyšl*, Petrograd, 1914, **29**, 268–318.

Add. 1914.1

Emerson, Alfred. Greek animal drawings. The studies of Morin-Jean. *Scient. Amer. Suppl.*, 1914, **77**, 154–158. 13 figs.

Add. 1914.1

Some ancient Greek vase-paintings of fishes are reproduced.

Emerson, B. K. Geology of old Hampshire county, Massachusetts, U. S. Geol. Survey, Monographs, **29**. Washington, 1898, 790 p. 32 pls. maps.

Add. 1898.1

List of Triassic fishes, 398–400.

Emmons, Ebenezer [1799–1863] American geology, containing a statement of the principles of the science, with full illustrations of the characteristic American fossils, with an atlas and a geological map of the United States. 1857, pt. vi, i–x, 1–152 p. 114 figs. 10 pls.

Add. 1857.1

Describes *Microdus laevis* and *Rabdiolopsis speciosa* from Triassic of North Carolina.

Endicott, Francis. Striped bass (In Mayer, A. M., Sport with gun and rod, etc., p. 449–472. New York, 1863)

Add. 1883.1

Engelmann, Theodor Wilhelm [1843–] Die Blätterschicht der electrischen Organe von Raja in ihren genetischen Beziehungen zur quergestreiften Muskelsubstanz. *Archiv. Physiol.* (Pflüger) 1894, **57**, 149–180. — Onderzoek. *Physiol. Lab. Hoogeschool*, Utrecht, 1895, **3**, 307–350. Add. 1894.1

Complete reference for Engelmann, T. W., 1894.1

Engmann, P. Die Cichliden. I. Der Chanchito, *Heros facetus* Jenyns. Braunschweig, 1911. 29 p. pl. 16. (Bibliothek für Aquarien- und Terrarienkunde, Heft 12)

Add. 1911.1

— Der Scheibenbarsch und *Amibassis lala*. Braunschweig, 1911. 27 p. pl. & fig. 16° (Bibliothek für Aquarien- und Terrarienkunde, Heft 17)

Add. 1911.2

Engström, A. Om fjällens byggnad hos *Osteroperygii* jemte några undersökningar öfver Sidoliniens Fjöll hos Skandinaviens Fiske. Inaug. Dissert. Lund, 1874. 4 pls.

Add. 1874.1

Erdland, P. A. Die Marshall-Insulaner: Leben und Sitte, Sinn und Religion eines Südsee-Volkes. *Anthropos-Bibliothek*, Münster, 1914, **2**, 1–376. 14 pls.

Add. 1914.1

Fischfang, p. 46–54.

Erdweg, P. Mathias Josef. Die Bewohner in der Insel Tumleo, Berlinhafen, Deutsch-Neu-Guinea. *Mittheil. Anthropol. Ges. Wien*, 1902, **32**.

Add. 1902.1

Fishing and fishery apparatus, p. 330–335.

Ergomyšev, N. Ein Beitrag zur Fütterung und zum Wachstum der Sterlet-Brut (Text in Russian). *Ryboprom. Žizni*, Petrograd, 1914, **3**, 224–230.

Add. 1914.1

Erhard, Hubert. Studien über Flimmerzellen. *Arch. Zellforsch.*, 1910, **4**, 309–442. 2 pls. & 16 figs.

Add. 1910.1

Erichsen, John. Nockrar hugvekiur um Veidi og Verkun á Laxi, Sild og öðru síófánga (Nogle betænkninger om fangst og virkning af lax, sild, og anden fisk). *Rit Petz Islenska Lærdoms-Lista Felags*, Kjöbenhavn, 1783, **3**, 86–121. 8°.

Add. 1783.1

Erichson, — Reptilia, fishes, mollusca (In Reports on the progress of zoology and botany, 1841–1842. London, 1845. 514 p. 8°.)

Add. 1845.1

Ernst, Gustav Adolf. On some interesting cases of migrations of marine fishes on the coast of Venezuela at Carúpano. *Nature*, 1886, **33**, 321–322.

Add. 1886.1

Escher, Johann Heinrich. Von der Teich-Wirtschaft und derselben Vortrefflichkeit und vorzüglichem Nutzen. *Abhandl. Naturf. Gesell. Zürich*, [1763–64?] **2**, 219.

Add. 1763.1

Esdaile, (Miss) Philippa C. Salmon scale research [Abstract] *Nature*, 1912, **90**, 533.

Add. 1912.1

Espitallier, G. Le port de Bizerte et les pêcheries. *La Nature*, 1901, **29**, pt. 2, 131–134. 3 figs.

Add. 1901.1

Estes, D. C. [On the habits of *Amia calva*] (In Hallock, Charles, The sports-

Estes, D. C.

man's gazetteer and general guide. New York, 1887) Add. 1887.1

Alleged oral gestation, p. 324-326.

Eter, Paul. *Limia ornata* und *Limia nigrofasciata* Regan. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 151-153. 4 figs. Add. 1914.1

Etheridge, Robert. Fossils of the British Islands stratigraphically and zoologically arranged. Vol. I. Palæozoic, etc. Oxford, 1888. 468 p. 4°. Add. 1888.1

List of Silurian fishes, p. 128-129; Devonian, p. 169-176; Carboniferous, p. 319-343; Permian, p. 373-375.

Evancar, Josef. Etwas über *Pterophyllum scalare* und seine Zucht. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 449-451. Add. 1914.1

Evans, A. Kelly. The practical enforcement of fishery regulations. Trans. Amer. Fisheries Soc. 1910 (1911), 299-308. Add. 1911.1

Evans, William. *Liparis montagui* (Donov.) in "Forth." Ann. Scott. Nat. Hist., 1897, 255-256. Add. 1897.1

— Blue shark in the Firth of Forth. Ann. Scott. Nat. Hist., 1898, 239. Add. 1898.1

Evermann, Barton W. [1853-] The Alaska fisheries service. Trans. Amer. Fisheries Soc. 1910 (1911), 219-226. Add. 1911.1

Evermann, B. W., Smith, H. M., Cobb, J. N., & Kendall, W. C. See **Smith, Evermann, Cobb, & Kendall.**

Evers, F. S. De Hollandsche haring-visschereij in 1905. Medel. Visch., 1906, 13, 45-49. Add. 1906.1

Ewald, W. F., & Loeb, Jacques. See **Loeb & Ewald.**

Ewart, James Cossar [1851-] Report on the progress of fish culture in America. Rept. Fishery Board Scotland, 1885, 3, 78-91. Add. 1885.1

— Are herring ova likely to develop normally on the deep offshore fishing banks? Rept. Fishery Board Scotland, 1886, 4, 43-46. Add. 1886.1

— On the artificial hatching and rearing of sea fish. Rept. Fishery Board Scotland, 1887, 5, 230-244. Add. 1887.1

— On the nature of 'red cod.' Rept. Fishery Board Scotland, 1888, 8 (pt. 3), 204-207. Add. 1888.1

Ewart, James Cossar, & Fulton, T. Wemyss. Report on the spawning of the British marine food-fishes. 7. Rept. Fishery Board Scotland, 1889, 186-221. Add. 1889.1

Ewart, J. C., & Maitland, J. R. G. Report on the trawling experiments on the east coast. Part I. Preliminary. Rept. Fishery Board Scotland, 1887, 5, 43-217. Add. 1887.1

— Report on the trawling experiments of the "Garland," and the statistics of east coast fisheries. Part. ii. Rept. Fishery Board Scotland, 1888, 6, (pt. 3), 25-188. Add. 1888.1

Ewart, J. C., Maitland, J. R. G., & Fulton, T. Wemyss. Report on the trawling experiments of the "Garland," and on statistics of east coast fisheries. Part. iii. Rept. Fishery Board Scotland, 1889, 7 (pt. 3), 15-157. Add. 1889.1

Ewart, J. C., & Matthews, J. Duncan. On the nature of Thames and Forth whitebait. Rept. Fishery Board Scotland, 1886, 4, 98-100. Add. 1886.1

F

F., V. Bulletins mensuels. Ges. Luxemburg. Naturfreunde, 1911, n. s. 5, 249-257. Add. 1911.1

Enumerates at p. 254 the new fishes collected by Luja in the Belgian Congo (Sankuru) *Labeo nigricans* Blgr., *Barilius lujæ* Blgr., *Haplochilus lujæ* Blgr., *H. ferranti* Blgr., *Schilbe mar-moratus* Blgr., and *Chonerinus africanus* Blgr.

F., W. Seltener Fisch [*Cantharus cantharus* L.] in Schweden. Mitth. Deutsch. Fischerei Ver., 1911, 27, 24. Add. 1911.1

Faber, E. Le grand-duché de Luxembourg au point de vue du régime forestier, de la chasse et de la pêche. Ann. Forestière Paris, 1913, 52, 481-494. Add. 1913.1

Fabre-Domergue, Paul [1861-] Sur une tumeur d'origine bactérienne observée chez le *Caranx trachurus* (Lacép.) C. R. Mém. Soc. Biol. Paris, 1890, 42, 359-361. Add. 1890.1

— Comment on pêche la sardine. Bull. Trim. Enseign. Pêches Maritimes, 1913, 18, 223-229. 6 pls. Add. 1913.1

— Le petit combattant d'Indo-Chine. [Betta] La Nature, 1914, 42, année, 1. sem., 433-435, 3 figs. Add. 1914.1

Fabre-Domergue, Paul, & Biéatrix, Eugène. Sur la reproduction de la sardine océanique. C. R. Cong. Internat. Pêches Marit. Sables-d'Olonne, 1896, 140-141. Add. 1896.1

Facciola, Luigi. Due nuove specie di leptocephalus del mar di Messina. Atti Soc. Nat. Modena, 1882 (1883), 3, ser. 1, 116-123. Add. 1883.1

— Rivista delle specie di leptocephalidi del mar di Messina. Atti Real. Accad. Palermitana, 1883, 5, 199. Add. 1883.2

— Descrizione di nuove specie di leptocephali dello stretto di Messina. Atti Soc. Tosc. Sci. Nat. (Memorie), Pisa, 1885, 6, fasc. 1, 3- Add. 1885.1

— Rinvenimento dell' *Arnoglossus lophotes*, Günt., nel Mar di Messina.

Rendic. Atti Soc. Nat. Modena, 1886, 3, 91-94. Add. 1886.1

— Tractatus per epistolam Francisci Maurolici ad Petrum Gillium de piscibus siculis. Nat. Sicil., 1893, 12, 180-183, 259-262, 276-281. Add. 1893.1

See also under Maurolico, F., 1893.1.

— Contrattilia muscolare nei pesci. Neptunia, Venezia, 1901, 16, 33-34. Add. 1901.1

— Sul rinvenimento della *Cephaloptera massenæ* Riss. nella stretto di Massena. Neptunia, Venezia, 1903, 18, 37-43; 49-53. Add. 1903.1

Description, classification, structure.

— Su di un nuovo tipo dei Nettastomidi. [*Nettastoma cancrivora* Günther] Boll. Soc. Zool. Ital., 1914, 3, ser. 3, 39-47. Add. 1914.1

Fage, Louis. Sur le *Gobius minutus* Pallas et quelques formes voisines. Bull. Soc. Zool. France, 1914, 39, 299-314. 6 figs. Add. 1914.1

— Sur les stades post-larvaires de l'*Uranoscopus scaber*. C. R. Assoc. Franç. Avanc. Sci., Paris, 1914, 43, 495-499. Add. 1914.2

Fage, L., & Legendre, R. Teneur des sardines en eau et en matières grasses. Bull. Mus. Hist. Nat. Paris, 1914, 101-103. Add. 1914.1

Age, length, weight, and seasons of physiological activity.

Fages, E. de, & Ponzevra, C. Les pêches maritimes de la Tunisie. 2. ed. revised by Georges Bourge. Tunis, 1908. 327 p. illust. Add. 1908.1
1st ed. Tunis, 1899.

Falch, Melchior. Om torske vaarfiskeriet paa Sundmöer. Nye Samling Norske Selsk. Skrift. 1788, 2, 213. Add. 1788.1

— Afhandling om fiskerierne i Norge i særdeleshed om de søndmørske og fiske-grundene uden for landet.

Falch, M.

Danske Landhuushold. Selsk. Skrift., 1790, 3, 289-344. Add. 1790.1

Faraday, F. J. [Intelligence in a skate] Nature, 1878-79 (1879), 19, 160. Add. 1879.1

Farr, S. C. Description of a California salmon (*Oncorhynchus*) found in one of the rivers of New Zealand and identified by Dr. T. H. Bean. Bull. U. S. Fish Comm., 1883, 3, 427. Add. 1883.1

Fassett, Harry C., & Bower, Ward T. See **Bower & Fassett**.

Fatio, Victor. Sur les Corégones (Féras diverses) de la Suisse. Arch. Sci. Phys. Nat., 1885, 14, 89-94. Add. 1885.1

Complete reference for Fatio, V., 1885.1.

— Mortalité exceptionnelle du brochet. [en 1886]. Arch. Sci. Phys. Nat., 1887, 17, 74-75. Add. 1887.1

Faujas de Saint-Fond, Barthélemy. Memoria epistolare per servire di schiarimento alla descrizione di un pesce petrificato scavato in altissimo nelle vicinanze di Bolca. Padova, 1807. 50 p. pl. 4°. Add. 1807.1

Faussek, Victor Andr. Ueber die Parasitismus der Anodonta-Larven in der Fischhaut. Biol. Centralbl., 1895, 15, 115-125. 5 figs. — Naturwiss. Wochenschr., Berlin, 1896, 11, 27-28. Add. 1895.1

— Ueber den Parasitismus der Anodonta-Larven. Verhandl. 5. Internat. Zool. Congress, Berlin, 1901, 761-766. Add. 1901.1

Fée, F. Le système latéral du nerf pneumogastrique des poissons. Inaug. Dissert. Strasbourg, 1869. 99 p. 4 pls. 4°. Add. 1869.1

Feilden, Henry Wemyss [1838-] Salmon and trout culture in Natal. Zoologist, 1893, 17, 57-60. Add. 1893.1

Felix, W. Entwicklungsgeschichte des Exkretionssystems, von der Rückertschen Arbeit (1888) bis in den Beginn des Jahres 1904. Ergebnisse Anat. Entwicklungsgesch., Wiesbaden, 1904, 13, 592-707. 42 figs. Add. 1904.1
Amphioxus, Myxine, Petromyzon, Teleosts.

Ferguson, Alexander. On the cause of the disappearance of young trout

from our streams. Trans. Proc. New Zealand Instit., 1888 (1889), 21 (n. s. 4), 235-237. Add. 1889.1

Native fish as enemies.

Ferguson, James. Nachricht von einem in King-road, unweit Bristol, gefangenen merkwürdigen fische [*Lophius piscatorius*]. Neu. Hamburg. Magaz., 1773, 380-383. Add. 1773.1

See also Ferguson, J., 1763.1

Fernandez, Cesar. Ordonnanzas de pesca para las provincias de Pontevedra (1750) y la Coruña (1769). Madrid, 1850. gr. 8°. Add. 1850.1

Report on the sprat fisheries of the coast of Galicia.

— Anuario . . . resumen de sus trabajos y noticias referentes á la industria pesquera, redactado . . . por . . . C. Fernandez. Año I & II. Com. Perm. Pesca, Madrid, 1868-1869. 8°. Add. 1868.1

Ferré, G., Artigalas, —, & Layet, A. See **Layet, Artigalas, & Ferré**.

Fiebiger, Josef. Ueber Karpfenkrankheiten. Oesterr. Fischerei-Zeitg., 1914, 11, 159-162; 175-177. Add. 1914.1

Figuier, Louis. The ocean world, being a description of the sea and its living inhabitants. New York, 1869. 615 p. illust. Add. 1869.1
Fishes, p. 502-596.

— The ocean world, edited and revised by E. Perceval Wright. London, 1891. 435 figs. Add. 1891.1
Fishes, p. 527-645.

Filippi, Filippo de [1814-1867] Ueber die Embryogenie der Fische. Isis, 1843, 404. Add. 1843.1

— Ueber die Schwimmblase des *Oligopus ater* Risso. Zeitschr. Wiss. Zool., 1855, 7, 170-171. Add. 1855.1

Gadopsis, p. 170; orthotype *Oligopus ater* Risso. Name preoccupied by *Gadopsis* Rich (1844). It may be replaced by the new name, *Verater* Jordan, orthotype *Oligopus ater* Risso.

Finck, M. C. *Haplochilus calliurus* Blgr. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 421-423. Add. 1914.1

— Neuere vivipare Zahnkarpfen. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 225-227. 2 figs. Add. 1914.2

Finsch, O. Ethnologische Erfahrungen und Biligstücke aus der Südsee.

Beschreibender Katalog einer Sammlung im K. K. naturhistorischen Hofmuseum in Wien. Ann. Naturhist. Hofmuseum, 1888, **3**. *Ibid.*, 1891, **6**.
Add. 1888.1

Fishing implements in Bismarck Archipelago: nets, hooks, harpoons, shark rattles, nooses, **3**, 107-108; 334-335. In English New Guinea, **6**, p. 31; in Kaiser Wilhelmsland, **6**, p. 52-53.

Fischer, E. Die Ostsee-Fischerei in ihrer jetzigen Lage. Conseil Perm. Intern. Explor. Mer, Copenhagen, 1904-1905. 140 p. 12 pls. & 2 figs. 4°.
Add. 1904.1

Fischer-Benzon, R. von. Ueber die "Physica" der heiligen Hildegard, die erste Naturgeschichte Deutschlands. Schrift. Naturw. Ver. Schleswig-Holstein, 1895, **10**, 133-145. Add. 1895.1

Fischer von Waldheim, Gotthelf [1771-1853] Sur un nouveau genre de vers intestins, [*Cystidicola farionis*] trouvé dans la vessie natatoire de la truite. Mag. Encycl., Paris, 1797, **3**, 437. — Bull. Soc. Philom., 1798, **1**, pt. 2, 98. — Journ. Phys. Chim. Hist. Nat., 1798, **47**, 304-309. — Arch. Physiol., Halle, 1799, **3**, 95-100. pl.
Add. 1797.1

— Mémoire pour servir d'introduction à un ouvrage sur la respiration des animaux, contenant la bibliographie; suivi de quelques remarques sur les milieux des vers intestins, et en particulier sur le *Cystidicola farionis*. Paris, 1798. 106 p. pl. 8°.
Add. 1798.1

Respiration of fishes, p. 76.

— Naturhistorische fragmenten. Vol. 1. Frankfurt-a-M., 1801.
Add. 1801.1

Notes on respiration and circulation in fishes, p. 213-238.

— Zoognosia, tabulis synopticis illustrata in usum prælectionum Academiae Imperialis Medico-Chirurgicae Mosquensis. 3rd ed. 2 vols. Mosquæ, 1813, xii, 466; xxiii, 605 p. 4° & 8°.
Add. 1813.1

Pisces, vol. I, p. 69-117.

— Recherches zoologiques. Mém. Soc. Imp. Nat. Moscou, 1812-13. (réimprimés 1830, **4**, 252-275)
Add. 1830.1

iii. Sur la Nawaga [*Eleginus* or *Gadus*] 252-264. 4 pls.

iv. Notices sur l'anatomie [Eye and articulation annular] des poissons. 265-275.

— Sur les dents de requins et les coprolithes enfermés dans les pyromarques arrondies de Volhynie. Bull.

Soc. Imp. Nat. Moscow, 1835, **8**, 234-244.
Add. 1835.1

Fisher, J. La pêche à toutes lignes, théorique, pratique et raisonnée. Paris, 1909. 347 p. 4 pls. 40 figs. 8°.
Add. 1909.1

An earlier edition, Paris, 1881.

Fleeharty, John. The commercial fisheries of lake Erie. Rept. State Comm. Fisheries Pennsylvania, 1897, 194-214.
Add. 1897.1

Fleming, John. The philosophy of zoology, or view of the structure, classification, etc., of animals. 2 vols. Edinburgh, 1822. 8°.
Add. 1822.1

Fishes, vol. II, p. 305-397.

Fletcher, — (On the aestivating Galaxias of Tasmania) Proc. Linn. Soc. New South Wales. 1906, **31**, 497-498.
Add. 1906.1

Fletcher, J. C., & Kidder, D. P. Brazil and the Brazilians. 6. ed. Boston, 1866.
Add. 1866.1

Letters of Major Coutinho on Agassiz's voyage up the Amazon, and data on fishes.

Notes on fishes, p. 627-633 and elsewhere.

Fliezbach, Otto. Das Laichgeschäft des *Chromis multicolor* (In E. Zernicke. Leitfaden für Aquarien und Terrarienfrennde. Dresden, 1907, p. 184-198)
Add. 1907.1

Floericke, Kurt. Meeresfische. Stuttgart, 1914. 96 p. 23 figs.
Add. 1914.1

A concise popular account of sea fish and fisheries.

Flourens, [M. J. P.] [1794-1867] Cours sur la génération, l'ovologie et l'embryologie fait au Muséum d'Histoire Naturelle en 1836. Paris, 1836. 10 pls. 4°.
Add. 1836.1

Viviparity in requin shark, p. 163. Translated into German as follows:

— Vorlesungen über Befruchtung und Ei-Bildung. Berlin, 1838. 8°.
Add. 1838.1

Flowerdew, H. The parr, salmon, whitling and yellowfin controversy. 2. ed. Manchester, 1883. Add. 1883.1

Fol, Hermann. Les pêcheries de la Corse. Rev. Mar. et Colon., 1894, **121**, 651-655.
Add. 1894.1

Foley, Antoine-Edward. Etude médicale, hygiénique et biologique. Paris, 1863. 8°.
Add. 1863.1

Contains data on the swimming bladder of fishes.

Foley, W. An unusual sea monster [*Rhineodon typus*] in the bay [of Bengal] Journ. Asiatic Soc. Bengal, 1835, 4, 62-63. Add. 1835.1

Fonssagrives, J. B., & Méricourt, Leroy de. Recherches sur les poissons toxicophores exotiques des pays chauds. Ann. Hyg. Pub. Méd. Lég., 1861, 2. ser. 16, 326-359. Add. 1861.1

22 species named. Ciguatera, p. 353-359.

Forbes, E. Outlines of the natural history of Europe. The natural history of the European seas. By E. Forbes . . . edited and continued by R. [A. C.] Goodwin-Austen. London, 1859. viii, 306 p. map. 8°. Add. 1859.1

Forbes, Henry O. A naturalist's wanderings in the Eastern Archipelago. A narrative of travel and exploration from 1876-1883. New York, 1885. 536 p. illust. Add. 1885.1

Considerable data about fishes.

— On a new genus of fishes [*Plagiogeneion*] of the family of Percidæ, from New Zealand. Trans. Proc. New Zealand Instit., 1889 (1890), 22, (n. s. 5), 273-275. Add. 1890.1

— Batrachia, pisces. (Note.) (In Grant, W. R. O., & Forbes, H. O. The natural history of Sokotra and Abd-el-Kuri: being the report upon the results of the conjoint expedition to these islands in 1898-9, etc. Liverpool, 1903, xlvii, 598 p. 33 pls. map. illust. 8°.) Add. 1903.1

Forbes, Stephen Alfred. The first food of the common whitefish. Bull. Ill. State Lab. Nat. Hist., 1882, 6. Add. 1882.1

— Notes on the food of the fishes of the Mississippi valley. 8. Ann. Rept. Fish. Comm. Michigan, 1888, 86-89. Add. 1888.1

— Freshwater fishes and their ecology. Ill. State Lab. Nat. Hist., 1914, 1-19, 11 pls. & 21 maps. Add. 1914.1

Forbes, Stephen A., & Richardson, R. E. Studies on the biology of the upper Illinois river. Bull. Ill. State Lab. Nat. Hist., 1913, 9, art. 10, 481-574. 21 pls. Add. 1913.1

Forel, Auguste Henri. L'action destructive du cygne sur les poissons. Bull. Soc. Vaud., Lausanne, 1900, 36, xxiii-xxiv. Add. 1900.1

Forlan, Casper M. Observationes rariores medico-practicas, anatomicas. Geneva, 1769. Add. 1769.1

Contains a description of the fish *Guaperva*.

Forrest, Thomas. A voyage to New Guinea and the Moluccas from Balam-bangan, etc. London, 1779. 388 p. illust. maps. Add. 1779.1

Horned fish, p. 84; fishing for bonitos in the Moluccas, p. 101; fishing in Sulu with tuba plant, and with hook and line, p. 329.

Forster, John Reinhold [1729-1798] Observations made during a voyage round the world, on physical geography, natural history, etc., London, 1778. Add. 1778.1

South Sea fishes, 195-196, *Sparus* and *Tetrodon* poisonous, 209-211, 642-649; methods of fishing, 461-463.

German edition, Berlin, 1783; Dutch, 1790; French, [n. d.]

Fortin, Pierre. Continuation of the list of fish of the gulf and river St. Lawrence. (In Ann. Rept. Pierre Fortin, etc. Sess. Pop. Can., sess. 1864, 23, pt. 2, no. 5, app. 40. [Galley 20 & 21 not paged] — Ibid., 1865, 25, pt. 2, no. 25, 61-69. — Ibid., 1866, 26, pt. 3, no. 36, 69-79.) Add. 1864.1

Fortis, Alberto [*Giov. Batt.*] [1741-1803] Viaggio in Dalmazia. 2 vols. Venezia, 1774. sm. 4°. Add. 1774.1

Contains notes on Dalmatian fishes and particularly on the ship-retarding powers of *Remora*.

Other eds.: Bern, 1776 (German) — French trans. from same press, 1777. English ed. follows:

— Travels in Dalmatia. London, 1778. Add. 1778.1

Remora as a ship-holder, p. 260-263; 325.

— Extrait d'une lettre au Comte de Cassini sur différentes pétrifications. Journ. Phys., Paris, 1786, 28, 161-168. Add. 1786.1

Fossil fishes, — no horizon.

Fortuyn, A. B. D., & Kappers, C. U. Ariens. See **Kappers & Fortuyn**.

Foster, David. The scientific angler, being a general and instructive work on artistic angling. New York, 1883. 247 p. Add. 1883.1

Edited by William C. Harris.

Found, W. A. Fish-culture in Canada. Rept. Comm. Conservation Canada, 1912, 140-153. Add. 1912.1

Fountain, Paul (editor) Rambles of an Australian naturalist [Thomas

- Ward**, London and New York, 1907. 343 p. Add. 1907.1
See also Ward T., Add., 1907.1.
- Fourment, L.** Note sur un nématode nouveau parasite du merlan. Ann. Sci. Nat. (Zool.) 1884, 6. ser. 17, no. 5. 8°. Add. 1884.1
- Fourny-Dulys, —.** Catalogue des poissons qui se rencontrent dans le département de la Loire. Ann. Soc. Agricult. Indust. Sci. Loire, Saint-Etienne, 1864, 8, 49. Add. 1864.1
- Fowler, Henry Weed** [1878–] A review of the elasmobranchiate fishes of Japan. Proc. U. S. Nat. Mus., 1903, 26, 593–674, 2 pls. Add. 1903.1
- A check list of the fishes recorded from Pennsylvania. Rept. Dept. Fisheries Pennsylvania 1911–12 (1913), 76–100. Add. 1913.1
- *Curimatus spilurus* Cope, a wrongly identified Characin. Proc. Acad. Nat. Sci. Philad., 1914, 65, 673–675. Add. 1914.1
C. stigmaturus, n. sp. pro *C. spilurus* Cope.
- Description of a new blenny from New Jersey, with notes on other fishes from the Middle Atlantic states. Proc. Acad. Nat. Sci. Philad., 1914, 66, 342–358. fig. Add. 1914.2
Blennius foxi, n. sp.
- Fishes collected by the Peary relief expedition of 1899. Proc. Acad. Nat. Sci. Philad., 1914, 66, 359–366. 2 figs. Add. 1914.3
Two new species of *Lethotremus* are described.
- Fishes from the Madeira river, Brazil. Proc. Acad. Nat. Sci. Philad., 1914, 65, 517–579. 25 figs. Add. 1914.4
Descriptions of 23 new species of teleosts.
- Fishes from the Rupununi river, British Guiana. Proc. Acad. Nat. Sci. Philad., 1914, 66, 229–284. 20 figs. Add. 1914.5
Descriptions of 21 new species of teleosts.
- Fraas, Eberhard** [1862–1915] For memorial notices see Osborn, H. F. 1915.1; Stromer, E. 1915.1.
- Fraas, Oscar.** Die Fauna von Steinheim. Stuttgart, 1870. 54 p. 11 pls. 4°. Add. 1870.1
Refers to *Tinca micropygoptera*, from Miocene of Württemberg.
- Fraenkel, F.** Der Schlaf der Fische. Blätt. Aquar.-Terrar. Kunde, 1909, 20, 608. Add. 1909.1
- Francis, Francis.** Clever fishes. Fraser's Magazine, 1872, n. s. 6, 11–20. Add. 1872.1
- Francis, George.** Spectrum of fish-pigment. Nature, 1875, 13, 167. Add. 1875.1
Analysis of blue-green pigment of *Odax*.
- Franck, P.** Berichte aus Argentinien. VI. Ueber die Loricariiden- oder Harnischwelse. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 621–625. fig. Add. 1914.1
- François-Franck, Ch. A.** Chrono-photographie d'un jet de liquide coloré montrant le trajet du courant de l'eau à travers la chambre respiratoire des animaux aquatiques. C. R. Mém. Soc. Biol., Paris, 1907, 62, 1. tome, 449. Add. 1907.1
See also note under François-Franck, Ch. A., 1906.2.
- Recherches anatomo-physiologiques sur le cœur et l'appareil circulatoire des poissons. II. Cœur de la torpille et du congre. C. R. Soc. Biol. Paris, 1914, 75, 688–691. fig. Add. 1914.1
"Chrono-photographies des pièces anatomiques."
- Franz, Victor.** Neues über den Aal und seine Verwertung. Himmel und Erde, 1913, 25. Jahrg., 261–266. Add. 1913.1
- Ueber das Ortsgedächtnis bei den Tieren. Monatsh. Nat. Unterr., 1913, 6, 161–178. Add. 1913.2
- Einige biologisch-optische Probleme. Bemerkungen zu der Arbeit von C. Hess. "Untersuchungen zur Physiologie des Gesichtssinnes der Fische." [Add. 1914.1] Zeitschr. Biol., 1914, 64, 51–60. fig. Add. 1914.1
Biological significance of phototaxis in fishes.
- Fraser, C. MacLean.** Pacific coast biological station, Departure bay, B. C. Trans. Pacific Fisheries Soc. 1914 (1915), 61–69. Add. 1914.1
- Frederichs, Georg.** Bemerkung über einige oberpaläozoische Fossilien von Krasnoufmsk [Text in Russian with German résumé] Kazani Prot. Obsch. Jest. 1911 (1912), Beilage no. 269, 1–8. pl. Add. 1911.1

Fredericq, Léon. Die Sekretion von Schutz- und Nutstoffen (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. II, Hälfte 2, p. 1-256. 38 figs. Jena, 1910).

Add. 1910.1

Giftfische und giftige Fische, p. 170-177 — bibliography.

Freeden, W. v., Dantziger, C., & Rensen, P. v. Der holländischer Hädings- und Frischfischfang [a report presented to the "Hochseefischerei Enquete-Commission"] Emden, 1871. 4°.

Add. 1871.1

Freeman, Gage Earle, & Salvin, Fr. H. Falconry, its claims, history and practice. To which are added remarks on training the otter and cormorant, by Captain Salvin. London, 1859. 8°.

Add. 1859.1

Fishing with cormorants, pp. 327-49; fishing with otters, pp. 350-2.

Frenzel, Johann Samuel Traugott. [1740-1807] Dissertatio inauguralis medica de torpedine veterum genere Raia. Quam . . . disputabit J. S. T. Frenzel. 1777. 4°.

Add. 1777.1

Freund, L. Eine abnorme Darmbildung beim Karpfen. Oesterr. Fischerei Zeitg., 1914, 11, 37-38.

Add. 1914.1

Freytag, G. Lichtsinnuntersuchungen bei Tieren. I. Fische. Arch. Vergl. Ophthalm. Leipzig, 1914, 4, 68-82.

Add. 1914.1

Friant, A. Recherches anatomiques sur les nerfs trijumeau et facial des poissons osseux. Bull. Soc. Sci. Nancy, Paris, 1879, 2. sér. 4, fasc. 9, 12. ann., 1. 6 pls.

Add. 1879.1

Complete reference for Friant, A., 1879.1.

Friedel, E. Geschichte der Fischerei. Internat. Fischerei Ausstell., 1880. Amtliche Berichte v. Berlin, 1881. 8°.

Add. 1881.1

Friederici, Georg. Wissenschaftliche Ergebnisse einer amtliche Forschungsreise nach dem Bismarck-Archipel im Jahre 1908. II. Beiträge zur Völker- und Sprachenkunde. Ergänzungsheft 5. Berlin, 1912.

Add. 1912.1

Methods of fishing, p. 149.

Friedlaender, Oscar O. Notes on the menhaden fishery. Bull. U. S. Fish Comm. 1883, 3, 459-461.

Add. 1883.1

Friedrich, Ernst. Von der künstlichen Fischzucht. [Salmon] Centralbl.

Ges. Forstwesen, 1913, 39. Jahrg., 312-321.

Add. 1913.1

Friis, Nic. Christian. Berättelse om sill-fiskeriet uti Norrlanden i Norrige. Kiöben. Selsk. Skrifter, [1770?] 10, 190.

Add. 1770.1

See Friis, Niclas Christian, 1770.1

— Bericht von der Dorsch-Fischerey in Norwegen. König. Schwed. Akad. Abhandl., 1770, 296.

Add. 1770.2

See note under Kästner, A. G., in Pre-L. section.

— Bericht von der Hädings-Fischerey in Norrland in Norwegen. König. Schwed. Akad. Abhandl., 1770, 159.

Add. 1770.3

See note under Kästner, A. G.

— Torske-fiskeriet i Nordlandene. Kiöben. Selsk. Skrift., [1770?] 10, 177.

Add. 1770.4

See Friis, N. C., 1770.2

— Berättelse om Hälle-Flundre och flundre-fiskeriet uti Nordlanden i Norrige. Vetensk. Acad. Handl., 1771, 247-254.

Add. 1771.1

See note under Kästner, A. G., in Pre-L. section.

— Bericht von der gräsiks-Fischerey in Nordland in Norwegen. König. Schwed. Akad. Abhandl., 1771, 46.

Add. 1771.2

See note under Kästner, A. G., in Pre-L. section.

— Graasey-fiskeriet i Nordlandene. Kiöben. Selsk. Skrift., [1771?] 10, 196.

Add. 1771.3

See also Friis, N. C., 1771.1

— Helle-flynder og Flynder-fiskeriet i Nordlandene. Kiöbenh. Selsk. Skrift., 1771, 10, 199-202.

Add. 1771.4

— Berättelse om brygd-fiskeriet [Cetorhinus maximus] i Norland en i Norrige; oversätt ifrån Danska språket. K. Svensk. Wet. Acad. Handl., 1772, 157-164. — Kiöben. Selsk. Skrift., 1772, 10, 202-205.

Add. 1772.1

— Berichte von den Fischereyen des Hälleflunder und Flunder in Norrland in Norwegen. König. Schwed. Akad. Abhandl., 1771 (1775), 33, 245-251.

Add. 1775.1

— Bericht von der Brygd-Fischerey in Nordland in Norwegen. König. Schwed. Akad. Abhandl., 1772 (1776), 34, 152.

Add. 1776.1

See note under Kästner, A.G., in Pre-L. section.

— Von der Altonaischen Heringsfischerey. Hannöv. Magaz., 1777, 1426. Add. 1777.1

Friis' papers are collected and published as:

— Afhandling om fiskerierne i Norlandene. Kiøbenhavn. Vidensk. Selskabs Skrift., 1778, 10, 177-205. Add. 1778.1

Frisch, Joh. Leonhard [1666-1743] Spuren der Erzeugung der Bandwürmer in Fischen und Vögeln, wie auch von den Spuhlwürmen und Bandwürmen in der Oberfläche der Leber der Fische und der Mäuse. Abhandl. Acad. Wiss. Berlin, 1781. phys.-med. Cl., 1, 158-160. fig. Add. 1781.1

Translation of Frisch, J. L., 1727.2, Pre-L. section.

— Von Bandwürmen in den Fischen, Abhandl. Acad. Wiss. Berlin, 1781, phys.-med. Cl., 1, 156-158. fig. Add. 1781.2

Translation of Frisch, J. L., Pre-L. section, 1727.1.

— Von den Bandwürmen in der Leber der Fische, vorzüglich des Hechtes. Abhandl. Acad. Wiss. Berlin, 1781, math.-phys. Cl., 2, 432-433. Add. 1781.3

Translation of Frisch, J. L., 1740.3, Pre-L. section.

— Von den Bandwürmen in einem gewissen stachlichten Fische, der in der Mark Brandenburg Stecherling genennt wird. Abhandl. Acad. Wiss. Berlin, 1781, phys.-med. Cl., 2, 129-130. Add. 1781.4

Translation of Frisch, J. L., 1734.2, Pre-L. section.

Frisch, K. von. Ueber Färbung und Farbensinn der Thiere. Sitzb. Ges. Morphol. Physiol. München, 1913, 28, 30-38. Add. 1913.1

Versuche an Crenilabrus und Phoxinus.

— Demonstration und Versuche zum Nachweis des Farbensinnes bei angeblich total farbenblinden Tieren (Phoxinus and Gasterosteus). Verh. Deutsch. Zool. Ges., 1914, 24. Vers., 50-58. fig. Add. 1914.1

Fritsch, Anton. Die künstliche Fischzucht in Böhmen, 1871-74. (In Arbeiten der Zoologischen Section der Landesdurchforschung von Böhmen. Archiv. Beide Comitè Landesdurchforschung Boehmen, Prague, 1873, 2. Bd., 2. Theil.) Add. 1873.1

Fritsch, A., & Vavra, V. Untersuchungen über die Fauna der Gewässer Böhmens. V. Untersuchung des Elbeflusses und seiner Altwässer durchgeführt auf der übertragbaren zoologischen Station. Prag, 1901. 154 p. illust. 8°. Add. 1901.1

Die Fische der Elbe und ihrer Altwässer bei Podicbrad, p. 27-36.

Fritsch, Karl von. Geognostische Skizze der Umgegend von Ilmenau am thüringer Walde. Zeitschr. Deutsch. Geol. Ges., 1860, 12, 97-155. 2 pls. Add. 1860.1

Pisces, p. 144, 152.

Fritz, Martin, & Hohenleiter, Wolfgang. See **Hohenleiter & Fritz.**

Frobenius, Leo. Völkerkunde in Characterbildern des Lebens, Treibens und Denkens der Wilden und der reiferen Menschheit. 2 vols. (in 1.) Hannover, 1902. Add. 1902.1

Bd. 2, Die reifere Menschheit. Fishing among ancient Egyptians, p. 273-275. 8 figs. Modern methods of fishing among primitive peoples, p. 282-287. Fishing with the board, p. 282-283. 3 figs.; with the kite, p. 285, fig.; with traps and snares, p. 285-288. 7 figs.

Frost, G. A. *Dapedius granulatus* [Abstract] Nature, 1913, 91, 129. Add. 1913.1

Fryer, Charles Edward. International regulations of the fisheries on the high seas (in Proc. 4. Intern. Fish. Cong., Washington, 1908) Bull. U. S. Bur. Fisheries 1908 (1910), 28, part 1, 91-102. Add. 1910.1

Fuchs, [?Joh. Christoph. 1726-1795] Nachricht und Beschreibung von einem bey Potsdam gefangenen Stör. Aller-neueste Mannichfalt., 1782, 1. Jahrg., 731. Add. 1782.1

Fuchs, R. F. Der Farbenwechsel und die chromatische Hautfunktion der Tiere (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. III, Hälfte 1, Theil 2, p. 1189-1656. 94 figs. Jena, 1914.) Add. 1914.1

Fische, p. 1372-1467. 21 figs.

Fuchs, Th. Beiträge zur Kenntniss der Miocaenfauna Aegyptiens und der libyschen Wüste. Palæontogr., 1883, 30, 30. Add. 1883.1

List of fossil fishes from Chalouf.

Fuhrmann, Otto. Ueber Mundbrutpflege bei *Scleropages osteoglossum* for-

Fuhrmann, O.

mosum. Actes Soc. Helvet. Sci. Nat. Lucerne, 88. session, 1905.

Add. 1905.1

Oral gestation, p. 68-69.

Fuji, K. Researches on the electric discharge of the isolated electric organ of *Astrape* by means of the oscillograph. Journ. Coll. Sci. Imp. Univ. Tokyo, 1914, **37**, 1-109, 30 pls. Add. 1914.1

Fulton, T. Wemyss, Ewart, J. C., & Gibson-Maitland, J. R. See **Ewart, Gibson-Maitland, & Fulton.**

Furneaux, W. S. The sea shore. London & New York, 1903. 436 p. illust. Add. 1903.1

Fishes, p. 306-342.

Furnell, (Surg.-Gen.) Michael Cudmore. Entozoa of Indian fishes. Indian Med. Gaz., 1884, **19**, 337-340.

Add. 1884.1

Furuya, —. Case of fugu (Tetrodon) poisoning [Text in Japanese] Tokei Zasshi, Osaka, 1881, (May 5). Add. 1881.1

G

Gabriel, B. Ueber die in der Harnblase des Hechtes sich findenden parasitischen Gebilde. *Jahrber. Schles. Ges. Vaterl. Cultur.* Breslau, 1879, **57**, 188-195. Add. 1879.1

Gabriel, Joseph. List of fish caught at Kent Islands. *Victorian Naturalist*, 1891, **7**, 136. Add. 1891.1

Gadd, Petro Adriano. Dissertation von den insekten welche der Fischerey schaden; übersetzt von H. Sander, mit zusätze von J. Beckmann. *Naturforscher*, 1775, **5**, 195-206. Add. 1775.1

Gadeau de Kerville, Henri. [1858-] [Sur le *Gobius albus*, Parnell, capturé sur les côtes de Normandie.] *Bull. Soc. Sci. Rouen*, 1886, **9**. Add. 1886.1

— L'orthagorisque mola. *La Nature*, 1894, 189-190. fig. Add. 1894.1

Gadsden, Fred. Ord. Fishing in Indian waters [1898-1900] *Journ. Bombay Nat. Hist. Soc.*, 1898-1900, **12**, 194-201, 404-409, 539-546, 726-733; *Ibid.*, 1900-01, **13**, 113-120, 355-361. Add. 1898.1

Gage, S. H. [On the eggs of eels] *Am. Quart. Journ. Micros. Sci.*, New York, 1878, **1**, 166. Add. 1878.1

— The respiratory mechanism of the lamprey (*Petromyzon*). *Proc. Amer. Assoc. Adv. Sci.*, 42. meet., 1893 (1894), 231. Add. 1894.1

Gage, Susanna Phelps. The brain of *Diemyctylus viridescens*, from larval to adult life, and comparisons with the brain of *Amia* and *Petromyzon*. (In Jordan, D. S., & others. *The Wilder Quarter-century book*, &c. Ithaca, N. Y., 1893. 8°.) Add. 1893.1

To replace Gage, S. H., 1893.1; an error.

Gaimard, Paul. *Voyage en Islande et au Groenland*, [1835-36].. Paris, 1838-1851. Add. 1838.1

Copy in N. Y. P. L. broken up into 7 vols. text in 8°, 1 vol. plates in large 4°, and 2 folio vols. of plates.

Twenty-two plates of fishes in folio. In vol. entitled "*Zoologie et médecine*" (p. 163) is a list of 21 fishes without descriptions.

Galard de Terraube, Louis Antoine. *Tableau de Cayenne ou de la Guiane françoise.* Paris 1799, 230 p.

Add. 1799.1

Fishes, chap. ix, p. 126-139.

Galikov, V. Ein Fall von Misbildung. [Text in Russian] *Bull. Soc. Nat.*, Charikov, 1914, **3**, 57-58.

Add. 1914.1

Galliani, Angelino. La pesca del tonno a Trapani. *Neptunia*, Venezia, 1903, **18**, 158-161. Add. 1903.1

Gallichan, W. M. Fishing in Wales. Guide to the angler. London, 1903. 212 p. 8°. Add. 1903.1

— Fishing in Derbyshire and around. London, 1905. 198 p. 8°. Add. 1905.1

— The complete fisherman. London, 1907. 229 p. illust. 8°. Add. 1907.1

Galloway, William. The flying fish. *Trans. Cardiff Nat. Soc.*, 1892, **23**, 26-33. Add. 1892.1

Gamble, F. W. The influence of light on the coloration of certain marine animals (*Hippolyte*, *Wrasses*) *Trans. Manchester Lit. Phil. Soc.*, 1909. Add. 1909.1

— The relation between light and pigment formation in *Crenilabrus* and *Hippolyte*. *Quart. Journ. Micros. Sci.*, 1910, **55**, 541-583. pl. Add. 1910.1

Gamble, F. W. & Drew G. H. Note on abnormal pigmentation of a whiting infected by trematode larvæ. *Journ. Mar. Biol. Assoc.*, 1910-13 (1911), n. s. **9**, 243. Add. 1911.1

Ganin, M. Ueber die Entwicklung des Kopfskeletts bei Knochenfischen (*Rhodeus*, *Gasterosteus*) *Zool. Anz.*, 1880, **3**, 140-141. Add. 1880.1

Garde, Aug. Smoking herring in Denmark. *Bull. U. S. Fish Comm.* 1885, **5**, 417-422. Add. 1885.1

Gardner, John Addyman, & Leet-ham, Constance. On the respiratory exchange in freshwater fish. Parts 1 and 2, on brown trout. *Biochem. Journ.*, 1914, **8**, 374-390; 591-597. 3 figs. Add. 1914.1

Influence of temperature and of size.

Gardner, J. W. A rain of small fishes. *Monthly Weather Rev.*, 1901 (1902), **29**, 263. Add. 1902.1

Garel, E. La pêche du hareng sur la côte sud de Bretagne. *Bull. Trim. Enseign. Pêches-Marit.*, Paris, 1911, **16**, 75-78. Add. 1911.1

Garel, J. Recherches sur l'anatomie générale comparée et la signification morphologique des glandes et la muqueuse intestinale et gastrique des animaux vertébrés. Thèse Faculté Médecine Lyon, 1877-78 (1879), **1**, no. 8. 84 p. 5 pl. Add. 1879.1

Gargano, Claudio. Implantationen von Geweben. II. Implantation von Selachierembryonen. *Arch. Path. Anat.*, 1914, **215**, 339-341. pl. Add. 1914.1

"Fortleben eines in die Milz implantierten Embryo."

Garman, Samuel [? 1846—] In regard to the "sea serpent" in literature. *Bull. U. S. Fish Comm.* 1884, **4**, 128. Add. 1884.1

"Sea serpent" likely to be a deep-sea fish or selachian.

— An eel (*Rhinomuræna quærita*) from the Marshall islands. *Bull. Essex Inst.*, 1888, **20**, 1-3. figs. Add. 1888.1

— The Massachusetts carp. *Ann. Rept. Comm. Inland Fisheries, Massachusetts*, 1890, **25**, 1-. Add. 1890.1

— New England saibling. *Ann. Rept. Comm. Inland Fisheries Massachusetts*, 1890, **25**, 12. Add. 1890.2

— The river trout. *Ann. Rept. Comm. Inland Fisheries Massachusetts*, 1890, **25**. Add. 1890.3

— Carp and trout. *Rept. Comm. Inland Fisheries & Game, Massachusetts*, 1890 (1891), 32-42. Add. 1891.1

— On *Balistes vetula* Linné. *Bull. Essex Inst.*, 1891, **22**, 53-55. Add. 1891.2

— *Silurus* (*Parasilurus*) *aristotelis*, *Glanis aristotelis*, Ag., 1856. *Bull. Essex Inst.*, 1891, **22**, 56-59. Add. 1891.3

Garman, S., & Agassiz, A. See **Agassiz, —, & Garman, —.**

Garsault, Fr. Ant. de. Figures des plantes et animaux d'usage en médecine. Paris, 1764. Add. 1764.1

Figures engraved after designs by Garsault.

— Explication abrégée de 719 plantes et de 134 animaux, en 730 planches gravées sur les dessins de De Garsault. Paris, 1765. Add. 1765.1

See also Geoffroy, E. L. Add. 1767.1.

Garstang, Walter. Recherches sur l'histoire naturelle du maquereau. Congrès Intern. Pêches Marit., Dieppe, 1897, 67. Add. 1897.1

Garstang, Walter, & Holt, E. W. L. See **Holt & Garstang.**

Garten, Siegfried. Beiträge zur Physiologie des elektrischen Organes der Zitterrochen. Vorläufige Mittheilungen. *Centralb. Physiol.* Leipzig & Wien, 1900, **13**, 1-4. Add. 1900.1

See also Garten, S., 1900.1.

— Beitrag zur Physiologie der marklosen Nerven. Nach Unterscheidung am Riechnerven des Hechtes. Jena, 1903. 15 pls. 4°. Add. 1903.1

— Die Veränderungen der Netzhaut durch Licht (In Gräfe-Sämisch, *Handbuch der Gesellschaft der Augenheilkunde*. 2 ed., p. 119-121. Leipzig, 1907) Add. 1907.1

Gasco, Francesco. Intorno ad un nuovo genere di pesci, etc. *Bull. Assoc. Nat. Med. Napoli*, 1870, 59-61. Add. 1870.1

Vexillifer, 59; orthotype *V. dephilippi* Gasco. A synonym of *Fierasfer*.

Gatcombe, John. Basking sharks [*Selachus maximus*] on the coast of Cornwall. *Zoologist*, 1885, 3. ser. **9**, 266. Add. 1885.1

— Fox sharks [*Squalus vulpes*] on the coast of Devon. *Zoologist*, 1885, 3. ser. **9**, 352-353. Add. 1885.2

Gathorne-Hardy, N. E. The salmon. London, 1898. 276 p. illust. Add. 1898.1

Chapters on salmon-fishing and on salmon cooking.

Gaudry, J. Albert. For biography see Eastman, C. R. 1909.1.

— Des espèces animales qui ont été recueillies dans le même gisement

que l'Actinodon. (In Mémoire sur le reptile découvert par M. Frossard à Muse (Saône-et-Loire) Nouv. Arch. Mus. Hist. Nat. Paris, 1867, **3**, 39-40. pl.) Add. 1867.1

Describes *Pleuracanthus frossardi* n. sp., from Permian.

Gaupp, Ernst. Alte Probleme und neuere Arbeiten über den Wirbeltierschädel. *Ergeb. Anat. Entwickl.*, Wiesbaden, 1900 (1901), **10**, 849-1001. Add. 1901.1

— Das Hyobranchialskelet der Wirbelthiere. *Ergeb. Anat. Entwickl.*, Wiesbaden, 1904, **14**, 808-1048. Add. 1904.1

Amphioxus, cyclostomes, selachians, ganoids, teleosts, dipnoans, p. 854-920. 7 figs.

— Die Entwicklung des Kopfskelettes. 1905. (In Hertwig, O. *Handbuch Entwicklungslehre der Wirbeltiere*, vol. iii, pt. 2, 1906) Add. 1905.1

Fishes, p. 627-688. 20 figs. This part appeared in 1905.

Gaver, F. van, Darboux, G., Stephan, P., & Cotte, J. See **Darboux, Stephan, etc.**

Gaylord, H. R. An epidemic of cancer in the thyroid of brook trout in a fish hatchery. *Journ. Amer. Med. Assoc.*, 1909, **52**, 411. Add. 1909.1

— An epidemic of carcinoma of the thyroid gland among fish. *Journ. Amer. Med. Assoc.*, 1910, **54**, 227. Add. 1910.1

— The production of thyroid hyperplasia in dogs from water associated with thyroid hyperplasia in fish. *Zeitschr. Krebsforschung*, 1912, **12**, 436. Add. 1912.1

Gaylord, H. R., & Marsh, M. C. The action of iodine and mercury on thyroid hyperplasia and carcinoma in fish. *Zeitschr. Krebsforschung*, 1912, **11**, 150. Add. 1912.1

— Relation of feeding to thyroid hyperplasias in Salmonidæ. *Zeitschr. Krebsforschung*, 1912, **12**, 436. Add. 1912.2

— Carcinoma of the thyroid in salmonoid fishes. *Bull. U. S. Bur. Fish.* 1912 (1914), **32**, 363-524. 54 pls. Add. 1914.1

Gaylord, H. R., Marsh, M. C. & Busch, F. C. Effects of iodine, mer-

cury and arsenic on thyroid hyperplasias and tumors in fish. *Zeitschr. Krebsforschung*, 1912, **12**, 437. Add. 1912.1

Gazola, (Conte) Giovambattista. *Ittiolitologia Veronese del Museo Bozziano, etc.* Verona, 1796-1809. Add. 1796.1

Erroneously attributed to Gazola (who collected the fossils), but correctly to Seraphino Volta (q. v. 1796.1) (who described them), on the basis of a note on p. ccxiii of vol. I of the above work which reads in part: "scritta dal celebre Professore Giovanni Seraphino Volta in Mantova."

Geddes, A. C. The origin of the vertebrate limb. *Journ. Anat. Physiol.* London, 1912, **46**, 350-383. fig. Add. 1912.1

Gegenbaur, Carl [1826-1903] For biographical notice see Voit, C. 1904.1.

Geides, H. Meine Erlebnisse mit *Polycentrus schomburgki*. *Blätt. Aquar.-Terrar.* Kunde, 1914, **25**. Jahrg., 129-133. 3 figs. Add. 1914.1
Berichtigung von Fritz Reuter. *Ibid.*, pp. 199-200.

— *Osphromenus trichopterus* (Pall.) var. *koelreuteri* Cuv. & Val., der getupfte Gurami. *Blätt. Aquar.-Terrar.* Kunde, 1914, **25**. Jahrg., 505-507. 2 figs. Add. 1914.2

Geikie, (Sir) A. Life of Sir R. I. Murchison . . . based on his journals and letters. With notices of his scientific contemporaries, and a sketch of the rise and growth of Palæozoic geology in Britain. 2 vols. London, 1875. 8°. Add. 1875.1

Geikie, Cunningham. The Holy Land and the Bible. 2 vols. New York, 1903. Add. 1903.1

Fish and fishing i, p. 17, 20, 84, 196, 202; ii, p. 296, 341-343, 346.

Geinitz, Eugen. Ueber neue Aufschlüsse im Brandschiefer der unteren Dyas von Weissig bei Pillnitz in Sachsen. *Neues Jahrb. Mineral.*, 1875, 1-14. Add. 1875.1

Fishes, p. 3-4; *Acanthodes gracilis* Beyr., *Palæoniscus angustus* Ag., and *P. vratislaviensis* Ag.

Geinitz, Hans Bruno. Das Quadersandsteingebirge, oder Kreidegebirge in Deutschland. Freiburg, 1849. 292 p. 12 pls. 8°. Add. 1849.1

Describes *Aulolepis reussi*, n. g. et n. sp., p. 86.

Gemmellaro, Mariano. Crostacei e pesci fossili del "Piano Siciliano" dei dintorni di Palermo. Giorn. Sci. Nat. Econ., Palermo, 1914, **30**, 73-114. 2 pls. Add. 1914.1

— Ittiodontoliti del calcare asaltifero di Ragusa in Sicilia. Giorn. Sci. Nat. Econ. Palermo, 1914, **30**, 25-44. 3 pls. Add. 1914.2

Gemmill, James F., & Linstow, Otto von. *Ichthyonema grayi* Gemmill und von Linstow. Archiv. Naturg., Berlin, 1902, 68. Jahrg. **1**, 113-118. pl. — Zool. Centralb., 1902, **9**, 448. — Centralb. Bakteriolog. Parasitenk., Jena, **34**, 70-71. Add. 1902.1

Gendersen Stort, A. G. H. van. Ueber Form und Ortsveränderungen der Elemente in der Sehzellenschicht nach Beleuchtung. Bericht 18. Versamm. Opthal. Gesell. Heidelberg, 1886, 43-49. Add. 1886.1

— Mouvements des éléments de la rétine sans l'influence de la lumière. Arch. Néerland. Sci. Exact. Nat., 1887, **21**, 316-386. Add. 1887.1

Gengou, O. De l'action empêchante du citrate de soude sur l'hémolyse par le sérum d'anguille. Arch. Intern. Physiol., 1908, **7**. Add. 1908.1

See also Gengou, O., 1907.1.

Gensch, H. Die sekundäre Entoderm und Blutbildung beim Ei der Knochenfische. Inaug. Dissert. Königsberg, 1882. Add. 1882.1

Geoffroy, Etienne François. Dissertation sur l'organe de l'ouïe de l'homme, des reptiles et des poissons. Amsterdam & Paris, 1778. 8°. Add. 1778.1

See note under Geoffroy-Saint-Hilaire, Etienne, below.

A German version is:

— Abhandlung von dem Gehörwerkzeuge des Menschen, der Amphibien und Fische. Leipzig, 1780. 8°. Add. 1780.1

Geoffroy, Étienne Louis [1725-1810] Description, vertus et usages de 719 plantes et de 134 animaux, en 730 pl. grav. sur les dessins de De Garsault, et rangées suivant l'ordre de la matière médicale de (Étienne Louis) Geoffroy. 5 vols. Paris, 1767. 472 p. 8°. Add. 1767.1

Describes following genera: *Ichthyocolla* (p. 399), type *Acipenser huso* L; *Harengus*

(p. 405), type *Clupea harengus* L; *Lucius* (p. 407), type *Esox lucius* L; *Trutta* (p. 719), type *Salmo trutta* L.

Title from Engelmann. Probably identical with the following from Agassiz: "Recueil de 730 planches, contenant des figures de plantes et d'animaux utiles en médecine." 5 vols. Paris, 8°.

Geoffroy-Saint-Hilaire, Etienne. Vol. I, p. 448; delete François, incorrectly inserted in this name. First two titles, 1778.1 and 1786.1 incorrectly cited there are correctly cited under Geoffroy, Etienne François, Pre-L. 1755.1 and Add. 1778.1.

Vol. I, p. 449; 1809.2, title should read Poissons du Nil. Delete rest of title erroneously inserted.

For biography see Flourens, M. J. P. Eloge historique d'E. Geoffroy-Saint-Hilaire. Mém. Acad. Sci. Paris, 1853, **23**, lxxi p. 4°.

Geoffroy-Saint-Hilaire, Isidore. Histoire générale et particulière des anomalies de l'organisation chez l'homme et les animaux. 3 vols. Paris, 1832-1836. atlas. Add. 1832.1
Review in Ann. Sci. Nat., 1832, **26**, 431.

Georg, Joh. Gottl. Bemerkung einer Reise im Russischen Reiche. 2 vols. St. Petersburg, 1775. 4°. Add. 1775.1

Callyoneymus baicalensis and some other fishes described. Abstract in Gött. Gel. Zeit., 1776.

Geppert, W. Eine indische Bartgrundel. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 814. Add. 1914.1

Gerard, W. R. The *Saprolegnia ferox* [on fishes] Proc. Poughkeepsie Soc. Nat. Sci., 1878-79, 25-28. Add. 1878.1

Gerdes Oosterbeek, W. F. Bibliography of fishing. (In his Encyclopædie van Nederlandsch Indië. 4 vols. 1895-1905, **4**, 567.) Add. 1905.1

— Vischery en Jacht. (In his Encyclopædie van Nederlandsch Indië. 4 vols. 1895-1905, **4**, 552-567.) Add. 1905.2

Gerhardt, Ulrich. Ueber die Oesophaguspapillen von *Ichthyococcus ovatus*. Verh. Deutsch. Zool. Ges., 1914, 24. Vers., 290-293. Add. 1914.1

"Sekretorische Organe. Vielleicht daneben auch Sinnesfunktionen."

Germar, Ernst Friedrich [1786-1853] Sur les empreintes des poissons dans les schistes bitumineux du Conté

de Mannsfeld. Bull. Ferussac, 1825, 266. Add. 1825.1

Translation of Gernar, E. F., 1824.1

— *Dorypterus hoffmanni* (In Münster, G. Beschreibung einiger merkwürdigen Fische aus den Kupferschiefern von Richseldorf und Eisleben. Beiträge zur Petrefacten-Kunde, 1842, 5. Heft, 35–37). Add. 1842.1

— Die Versteinerungen des Steinkohlengebirges von Wettin und Löbejün im Saalkreise (Petrificata Stratorum Lithanthracum Wettini), etc. [Text in German and Latin]. Halle, 1844–1853, 8. Hft., iv, 116 p. 40 pls. fol. Add. 1844.1

Describes *Styracodus*, p. 70, (1849), orthotype *Centrodus acutus* Giebel. A synonym of *Centrodus*.

Gerschler, W. M. Willy. Gibt es konstante Bastarde? Naturwissen., 1914, 2. Jahrg., 1039–1043. 6 figs. Add. 1914.1

— Ueber alternative Vererbung bei Kreuzung von Cyprinodontiden-Gattungen. Vorläufige Mitteilung. Zeitschr. Indukt. Abstammungs-Vererbungslehre, 1914, 12, 73–96. 14 figs. Add. 1914.2

— Zur Frage des *Xiphophorus racchovii* Regan. Ein Beitrag zum Problem der konstant-intermediären Vererbung. Zool. Anz., 1914, 44, 369–375. fig. Add. 1914.3

"Inkonstanz. Produkte der Rückkreuzung. Deutliche Spaltung."

Gervais, F. L. P. Ostéologie de la tête du vastrès et du mylétès. (In Castelnau, F. L., Expédition dans les parties centrales de l'Amérique du Sud, de Rio De Janeiro à Lima, et de Lima au Para; . . . etc. Tom. I. Anatomie, Paris, 1850. 100 p. 18 p. 8°. 4°. & fol.) Add. 1850.1

— Sur les empreintes végétales trouvées à Armissan (Aude) et détails géologiques et paléontologiques sur cette localité. Mém. Acad. Sci. Montpellier, 1862, 5, 309–324. Add. 1862.1
Leuciscus and *Cyclurus valenciennesii*, 320–321.

Getje, F. A. List of parasitic worms found in fish from the Moscow market. [Text in Russian] Bull. Soc. Sci. Moscow, 1886, 50, no. 1, 99–100. Add. 1886.1

Geyer, Hans. Die Heimat des Makropoden Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 619. Add. 1914.1

Ghibourt, J. B. G. Histoire naturelle des drogues simples. Paris, 1851. Add. 1851.1

Products obtained from fishes, vol. IV, p. 153–181.

Giacomini, Ercole. Il nervo terminale dei Salmonidi: contributo allo studio del nervo terminale nei Teleostei. Rendic. Accad. Sci. Bologna, 1914, n. s. 18, 67–74. Add. 1914.1

— Presentazione di girini di *Rana temporaria* e di avannotti di *Salmo fario* nutriti con tiroide di bue. Rendic. Accad. Sci. Bologna, 1913–14 (1914), 18, 116–121. Add. 1914.2

Giard, Alfred [1846–1908] Liste chronologique des publications de A. Giard (1869–1908) Bull. Sci. France Belgique, 1909, 42, xlv–lxxiii.

— Fragments biologiques. vii. Sur le commensalisme d'un Caranx et d'une Méduse. Bull. Sci. France Belg., 1887, 18, 46. Add. 1887.1

— [1846–1908] Les saumons de la Canche. Bull. Sci. France Belg., 1888, 19, 392–401. Add. 1888.1

— Fragments biologiques. xx. Sur la présence du thon (*Thynnus vulgaris* L.) dans la mer du Nord. Bull. Sci. France Belg., 1889, 20, 178–180. Add. 1889.1

— Sur le *Peroderma cylindricum* Heller, copépode parasite de la sardine. Bull. Sci. France Belg., 1889, 20, 312–314. Add. 1889.2

— La mémoire chez les poissons. Rev. Sci., 1897, 7, 410–411. Add. 1897.1

Gibbes, Robert Wilson [1809–1866] Mososaurus and allied genera. Smithsonian. Contrib. Knowl., 1850, 2. Add. 1850.1

Refers to *Conosaurus*.

Gibbons, W. P. Description of four new species of viviparous fishes from Sacramento river and the bay of San Francisco. Proc. Acad. Nat. Sci. Philad., 1854, 7, 105–106. Add. 1854.1

Gibbs, Thomas. The larva of the eel. Trans. Nat. Hist. Soc. Burton-on-Trent, 1887, 3, 155–157. Add. 1897.1

Giberne, Agnes. The mighty deep and what we know of it. London, 1902. 290 p. illust. Add. 1902.1
Fishes, p. 230–251.

Giberne, A.

— The romance of the mighty deep. London, 1906. Add. 1906.1

Fishes, 230-251.

Giebel, C. G. A. [1820-1881] Die Amphibien und Fische. Leipzig, 1860. xxi, 408 p. 423 text-figs. Add. 1860.1

This is Band III of his "Die Naturgeschichte des Thierreichs" which in turn is Abth. I of "Die drei Reiche der Natur." Leipzig, 1859-64.

Gielleboel, Rojer. Naturlig og oekonomisk beskrivelse over Hølands præstegæld i Aggerhuus. Kiovenhavn, 1771. 8°. Add. 1771.1

A few fishes are enumerated.

Giffen, A. E. van. Die Fauna der Wurten. Erster Teil. Tijdschr. Nederl. Dierk. Vereen., 1913, 2. ser. 13, 1-166. 9 pls. Add. 1913.1

Giglioli, Enrico H. A singular case [mullet encased in colony of *Pyrosoma*] Nature, 1886, 34, 313. Add. 1886.1

— La collezione centrale degli animali vertebrati italiani nel Regio Museo Zoologico di Firenze. Atti Soc. Ital. Progr. Sci., 1909, 2. riun., 179-195. Add. 1909.1

Gilbert, Charles H. A new genus and species of cottoid fish [*Asemichthys taylori*] from Departure bay, Vancouver island, B. C. Contrib. Canadian Biol. 1906-10 (1912), 215-216 (Suppl. Ann. Rept. Dept. Mar. Fisheries, Fisheries Branch) Add. 1912.1

— Two cottoid fishes from Monterey bay, California. Proc. U. S. Nat. Mus., 1914, 47, 135-137. pl. Add. 1914.1

Enophrys taurinus, n. sp., and *Orthonopias triacis* S. & N.

Gilbert, Ch. H., & Jordan, David Starr. See **Jordan & Gilbert.**

Gilchrist, J. D. F. Description of three new South African fishes. Marine Biol. Rept. Union South Africa, 1914, no. 2, 128-131. 3 figs. Add. 1914.1

Three new species are described of *Dentex*, *Scylliorhinus*, *Selene*.

— Destruction of fish and fish spawn by netting in the Berg river and at Knysna. Marine Biol. Rept. Union South Africa, 1914, no 2, 75-89. 2 figs. Add. 1914.2

— An enquiry into fluctuations in fish supply on the South African coast.

Marine Biol. Rept. Union South Africa, 1914, no. 2, 8-35. pl. Add. 1914.3

Study of various destructive agencies.

— Observations on the habits of some South African fishes. Marine Biol. Rept. Union South Africa, 1914, no. 2, 90-115. 2 figs. Add. 1914.4

— The snoek and allied fishes in South Africa. Marine Biol. Rept. Union South Africa, 1914, no. 2, 116-127. 4 figs. Add. 1914.5

Thyrsites atun, *Lepidopus caudatus*, *Gempylus serpens*, *Trichiurus haumela*.

Gilchrist, J. D. F., & Thompson, W. Wardlaw. Descriptions of fishes from the coast of Natal. Part IV. Ann. South African Mus., 1914, 13, 65-95. Add. 1914.1

Descriptions of five new species of *Lepidotrigla*, *Trigla*, *Myxus*, *Platygllossus*.

Gill, Theodore Nicholas [1837-1914] For biography, see Dall, W. H., Biographical memoir of Theodore Nicholas Gill, 1837-1914. Nat. Acad. Sci., Biographical Memoirs, 1916, 8, 313-343. portr. Also Dall, W. H., Theodore Nicholas Gill. Rept. Smithsonian. Instit., 1916 (1917), 579-586.

The first reference contains a bibliography of Theodore Nicholas Gill, p. 322-343.

— [Review of] Girard's Fishes in Pac. R. R. report. Amer. Journ. Sci., 1860, 2. ser. 30, 277-281. Add. 1860.1

— Squalorum generum novorum descriptiones diagnosticæ. Theodore Gill, auctore. Ann. Lyc. Nat. Hist. New York, 1862, 7, 409-413. Add. 1862.1

— [List of fishes] (In Hayden, F. V. On the geology and natural history of the upper Missouri. Trans. Amer. Philos. Soc., 1863, 5, (n. s. 12), 1-218.) Add. 1863.1

Platygobio Gill, p. 178; orthotype *Pogonichthys communis* Grd.—*Cyprinus gracilis* Rich. Scaphirhynchops, p. 178, to replace *Scaphirhynchus*, regarded as preoccupied.

— Note on the family of myliobatoids and on a new species of *Ætobatis*. Ann. Lyceum Nat. Hist., New York, 1865, 8, 135-138. Add. 1865.1

— Pisciculture with reference to American waters. U. S. Dept. Agric., Ann. Rept., 1866. 394-423. Add. 1866.1

— The fish fauna of Massachusetts—comparison with the fishes of the

Caribbean sea and of Europe. Bull. Phil. Soc. Washington, 1872, **1**, 52.
Add. 1872.1

— On the status of Aristotle in systematic zoology. Amer. Naturalist, 1873, **7**, 458–463.
Add. 1873.1

— Remarkable instances of indigestion among fishes (*Chiasmodon niger*) Bull. Phil. Soc. Washington, 1875–80, **3**, 116.
Add. 1875.1

— Vertebrate zoology (In General summary of scientific and industrial progress in 1876. Annual record of industry and science for 1876 (1877), clxvi–clxxiv).
Add. 1877.1

Proposes Lycichthys, type *Anarrhichas latifrons* St. & Hallg.

— Pisciculture. The Mirror, Baltimore, 1878, **2**, 1–6.
Add. 1878.1

— On the affinities of the great swallower, *Chiasmodon niger*. Forest & Stream, 1879, **13**, 906. — Proc. Biol. Soc. Washington, 1880–82, **1**, 35.
Add. 1879.1

— Dr. Günther's Ichthyology. Science, 1881, **2**, 323–327.
Add. 1881.1

— The principles of biology with reference to taxonomy. Proc. Biol. Soc. Washington, 1880–1882 (1881), **1**, 26, 102–104.
Add. 1881.2

— Principles of morphology. Bull. Phil. Soc. Washington, 1881, **4**, 123.
Add. 1881.3

From Johnson's Encyclopædia, under the title "Morphology," (by Gill).

— The ichthyological peculiarities of the bassalian fauna. Science, 1884, **3**, 620–622.
Add. 1884.1

— New families of fishes (*Stephanoberycidae* and *Derichthyidae*) recently added to the deep sea fauna. Amer. Naturalist, 1884, **18**, 433.
Add. 1884.2

— The oldest living type of vertebrates (*Chlamydoselachus*) Science, 1884, **3**, 346. *Ibid.*, 1884, **4**, 524.
Add. 1884.3

— On the survival of fish embryos. Forest & Stream, 1884, **23**, 51. — Amer. Naturalist, 1884, **18**, 1052–1053.
Add. 1884.4

— The principles of zoogeography. Proc. Biol. Soc. Washington, 1882–1884 (1884), **2**, 1–39.
Add. 1884.5

— The relations of *Didymodus* or *Diplodus*. Science, 1884, **3**, 429–430.
Add. 1884.6

— What are the saccopharyngoid fishes? Nature, 1884, **29**, 236.
Add. 1884.7

— The chief characteristics of the North American fish fauna. Trans. Amer. Fisheries Soc., 1885, 69–72.
Add. 1885.1

— (On the system of the Squali) Proc. Biol. Soc. Washington, 1885, **2**, lxiii–lxiv.
Add. 1885.2

— The characteristics and relations of the ribbon fishes. Amer. Naturalist, 1887, **21**, 86.
Add. 1887.1

— *Glyptocephalus* not identical with *Bucklandium*. Amer. Naturalist, 1888, **22**, 925–926.
Add. 1888.1

— Note on the genus *Gobiomorus*. Proc. U. S. Nat. Mus., 1888, **11**, 69–70.
Add. 1888.2

— Note on the genus *Spheroides*. Proc. U. S. Nat. Mus., 1888, **11**, 607–608.
Add. 1888.3

— On the proper generic name of the tunny and albacore. Proc. U. S. Nat. Mus., 1888, **11**, 319–320.
Add. 1888.4

— On the *Psychrolutidae* of Günther. Proc. U. S. Nat. Mus., 1888, **11**, 321–327. pl.
Add. 1888.5

— The "hatchery" of the sun-fish. Nature, 1889, **40**, 319.
Add. 1889.1

— Note on the genus *Dipterodon*. Proc. U. S. Mus., 1889, **11**, 69–70.
Add. 1889.2

— On the proper name of the genus *Labrax* of Cuvier. Proc. U. S. Nat. Mus., 1889, **11**, 252.
Add. 1889.3

— On *Eleginus* of Fisher, otherwise called *Tilesia* or *Pleurogadus*. Proc. U. S. Nat. Mus., 1891, **14**, 303–305.
Add. 1891.1

— On the genera *Labrichthys* and *Pseudolabrus*. Proc. U. S. Nat. Mus., 1891, **14**, 395–404.
Add. 1891.2

— On the genus *Chonerhinus* or *Xenopterus*. Proc. U. S. Nat. Mus., 1891, **14**, 697–699.
Add. 1891.3

— On the genus *Gnathanacanthus* of Bleeker. Proc. U. S. Nat. Mus., 1891, **14**, 701–704.
Add. 1891.4

Gill, T. N.

— On the genus *Hiatula* of Lacépède or *Tautoga* of Mitchell. Proc. U. S. Nat. Mus., 1891, **14**, 695.

Add. 1891.5

— An Australasian sub-family of fresh-water Atherinoid fishes (*Melanotænünæ*) Amer. Naturalist, 1894, **28**, 708-709.

Add. 1894.1

Proposes *Rhombatractus*, p. 709; a substitute for *Aristeus* Castelnau, preoccupied.

— On the *Belone* and *Sarginos* of Aristotle. Science, 1895, n. s. **2**, 703.

Add. 1895.1

— The characteristics of the families *Salmonidæ* and *Thymallidæ*. Proc. Biol. Soc. Washington, 1896, **10**.

Add. 1896.1

— Vertebrata of the land; fishes, batrachia, and reptiles [of the Antarctic and adjacent regions] Science, 1896, n. s. **3**, 314-317.

Add. 1896.2

— Distinctive characters of the *Molinæ* and *Ranzaniinæ*. Science, 1897, n. s. **6**, 966-967.

Add. 1897.1

— Zoology. (In the Smithsonian Institution 1846-1896. The history of its first half century. Edited by George Brown Goode. Washington, 1897, chap. ix, 711-744.)

Add. 1897.2

— On the relations of the nematognaths. Amer. Soc. Adv. Sci., 1898, 46. meet., 235.

Add. 1898.1

— On the zoogeographical relations of Africa. Science, 1900, n. s. **11**, 900-901.

Add. 1900.1

— The bones of the shoulder girdle in fishes. Science, 1903, n. s. **17**, 255-256.

Add. 1903.1

— The devil-fish and some other fishes in North Carolina. Forest & Stream, 1903, **9**, 431.

Add. 1903.2

— Homologies of anterior limbs. Science, 1903, n. s. **17**, 488.

Add. 1903.3

Polypterus as key to problem.

— The systematic relations of the fish genus *Lampris*. Science, 1903, n. s. **17**, 256-257.

Add. 1903.4

— Non-education of the young by parents [*Gobiids* and *Oncorhynchus*] Science, 1904, n. s. **19**, 861-862.

Add. 1904.1

— Vernacular names of animals. Amer. Naturalist, 1904, **38**, 241-242.

Add. 1904.2

Note on the "Allgemeines Polyglotten-Lexicon der Naturgeschichte," of Philip Andreas Nemnich. See Nemnich, P. A., 1793.1

— Life history of the common eel. Trans. Amer. Fisheries Soc., 1908, 115-121.

Add. 1908.1

— Contributions to the life histories of fishes, by Theodore Gill. Vol. I, 1904-1907. Washington, 1909.

Add. 1909.1

Reprints of papers from Smithsonian Miscellaneous Collections, Smithsonian Annual Report, and Proceedings U. S. National Museum. All these papers are correctly listed under their years of publication.

— A plea for observation of the habits of fishes and against undue generalization. Proc. 4. Intern. Fishery Cong., Washington, 1908. Bull. Bur. Fisheries 1908 (1910), **28**, part 2, 1059-1069.

Add. 1910.1

— The natural history of the weak-fish. Trans. Amer. Fisheries Soc. 1910 (1911), 269-276.

Add. 1911.1

Gill, T. N., & Baird, S. F. Memoranda of inquiry relative to the food fishes of the United States. Rept. U. S. Fish Comm. 1871-72, 1-3.

Add. 1872.1

— Questions relative to the food fishes of the United States. Rept. U. S. Fish Comm., 1871-72, 3-6.

Add. 1872.2

Gill, T. N., & Jordan, D. S. (The sun-fish) Field & Forest, 1877, 190.

Add. 1877.1

Eupomotis Gill & Jordan, 190; orthotype *Sparus aureus* Walbaum = *Labrus gibbosus* L.

Gill, William Wyatt. Life in the southern isles; or, scenes and incidents in the south Pacific and New Guinea. London, 1876.

Add. 1876.1

Fish and fishing, p. 278-289; fishing with the *Echeneis*, p. 292; "tickling" and noosing sharks at Aitutaki, p. 303-305.

— Jottings from the Pacific. New York, [1885?] 304 p. illust.

Add. [1885?].1

Turtle as prey of shark, p. 158.

The sting-ray, p. 159-163.

The poisonous n'ou fish of the Pacific, p. 163.

The sword-fish, p. 166-170.

Fish-poisoning at Raratonga, p. 170-175.

Method of fishing, p. 179-182.

Fish-diet, p. 273-274.

Gilpin, J. Bernard. On the salmon of Nova Scotia. Proc. Trans. Nova Scotia Inst. Sci. [1879?] **5**, 38-47.

Add. 1879.1

Gilruth, I. A. Epithelioma affecting the branchial arches of salmon and trout. Rept. New Zealand Dept. Agr., Div. Veterinary Sci., 1902. Add. 1902.1

Gilson, Gustave. Exploration de la mer sur les côtes de Belgique. 1. ser. Bruxelles, (Mus. Roy.), 1907. 87 p. 3 pls. 4°. Add. 1907.1

— L'anguille, sa reproduction, ses migrations et son intérêt économique en Belgique. Ann. Soc. Roy. Zool., Bruxelles, 1908. 54 p. pl. & 6 figs. Add. 1908.1

See also Gilson, G., 1908.1, in vol. I.

— Contribution à l'étude biologique et économique de la plie. Bruxelles, 1910. 127 p. 32 pls. 4°. Add. 1910.1

— Etudes sur l'outillage de la pêche. Le chalut à fers déclinants, types nouveaux d'armature à gaule. Gand, 1911. 35 p. 30 figs. 4°. Add. 1911.1

Giltay, Carel Marinus. Commentatio ad quæstionem . . . "Quæritur descriptio neurologica Esocis lucii . . . cum reliquis vertebratis animalibus . . . comparata," &c. Ann. Acad. Lugduno-Batavæ, 1831-32. (1833) 4°. Add. 1833.1

See also Giltay, C. M., 1832.1 in vol. I.

Ginanni, (Conte) Francesco. Istoria civile, e naturale delle pinete Ravennati nella quale si tratta della loro origine, situazione, terre molteplici, acqua, aria, fossili, vegetabili, animali terrestri, volatili, acquitili, anfibii, insetti, vermi, &c. Opera postuma del Conte Francesco Ginanni. Roma, 1774. 478 p. pls. maps. gr. 4°. Add. 1774.1

Girard, C. F. Les Andes, la Cordillère et l'Amazonie. C. R. Congrès Intern. Zool., Paris, 1889, 101-109. Add. 1889.1

Faunal discussion of Colombia, Ecuador, Peru and Bolivia.

— Lettre à M. le Dr. Raphael Blanchard. C. R. Congrès Intern. Zool., Paris, 1889, 99-101. Add. 1889.2

Discusses *Pimelodus cyclopum* and *Brontes prenadilla* in Ecuador.

Girard, C., & Baird, S. F. See Baird & Girard.

Giraud, J. Etude géologique sur la Limagne (Auvergne) Bull. Serv. Carte Géol., 1902, 13, no. 87. Add. 1902.1

Fossil fishes, p. 84, 168, 200, 213, 221, 239.

Giraud-Teulon, Marc Antoine Louis Félix. [1816-1887] Principes de mécanique animale, ou étude de la locomotion chez l'homme et les animaux vertébrés. Paris, 1858. 483 p. illust. 8°. Add. 1858.1

Gistel, Johannes. Naturgeschichte des Thierreichs für höhere Schulen. Stuttgart, 1848. Add. 1848.1

2nd edition, 1852.

Sixty-seven new generic names of fishes, many of them admissible. See Jordan, D. S. "The Genera of Fishes," Stanford Univ., Cal., 1919, Part II, pp. 233-238.

Glaettli, R. Einiges über die Labdrüsen des Magens. Inaug. Dissert., Zurich, 1852. Add. 1852.1

Glaser, L. Leben und Eigenthümlichkeiten in der mittleren und niederen Thierwelt. Abth. 1. Amphibien, Fische und Gliederthiere. Leipzig, 1868-70. 8°. Add. 1868.1

Second edition Leipzig & Berlin, 1882. 242 p. 6 pls. illust. 8°.

Gleditsch, Johann Gottlieb. Vom Ausbrüten der Fische. Stuttg. Phys. Oekon. [c. 1765], 6, 552. Add. 1765.1

Gley, E. De l'action des ichthyotoxines sur le système nerveux des animaux immunisés contre ces substances. Contribution à l'étude de l'immunité. C. R. Acad. Sci. Paris, 1907, 145, 1210-1212. Add. 1907.1

Gley, E., & Camus, L. See Camus & Gley.

Gobin, Alphonse [1828-] Trois questions de pisciculture marine (protection, migrations, courants) Mém. Soc. Agric. France, 1887, 131, 157-236. Add. 1887.1

Godet, Paul. Identité spécifique de la truite de rivière et de celle du lac. Bull. Soc. Sci. Neuchâtel, 1890, 18, 179-180. Add. 1890.1

Goeppert, Ernst. Die Entwicklung des Mundes und der Mundhöhle mit Drüsen und Zunge; die Entwicklung der Schwimmblase, der Lunge und Kehlkopfes der Wirbeltiere. (In Hertwig, O., Handbuch Entwicklungslehre, 2, pt. 1, 1-105. 82 figs. Jena, 1906) Add. 1902.1

Fishes, p. 1-84. 68 figs. This part appeared in 1902.

Götze, — Nachtrag zur Geschichte des Ruffolken (Gadus). Neuesten Mannichfaltigk., 1775, 2 Jahrg., 423; 619. Add. 1775.1

Goldenberg, Carl Friedrich [1798–1881] *Fauna Saræpontana fossilis. Die fossilen Thiere aus der Steinkohlenformation von Saarbrücken.* Saarbrücken, 1873. 2. Hft. illust. 4°. Add. 1873.1

Describes *Leiolepis*, p. 5, a synonym of *Amblypterus*.

Goldfuss, A. *Beiträge zur vorweltlichen Fauna des Steinkohlengebirges.* Bonn, 1847. 26 p. 5 pls. 4°. Add. 1847.1

Palæoniscus, *Amblypterus macropterus*, and *Orthacanthus*.

Goldschmidt, H. *Die deutsche Seefischerei in ihrer Gegenwart und die Mittel zu ihrer Hebung.* Berlin, 1911. Add. 1911.1

Goldschmidt, Richard. *Amphioxides.* *Wiss. Ergebn. Deutsch. Tiefsee-Expedition*, 1905, **12**, 1–92. 10 pls. & 11 figs. Add. 1905.1

Goldsmith, M. *Les reactions physiologiques et psychiques des poissons.* *Bull. Inst. Gen. Psychol.*, 1914, **14**, 97–228. Add. 1914.1

Goldsmith, Oliver [1728–1774] *History of the earth and animated nature.* 8 vols. London, 1774. pls. 8°. Add. 1774.1

This is the first edition. A second in 8 volumes appeared in 1779. There have been many since then. Two only are listed.

— *A natural history of remarkable birds and fishes. . . .* London [c. 1820] 184 p. figs. 12°. Add. 1820.1

An abridgment of "A history of the earth and animated nature."

— *A history of the earth and animated nature.* New York, 1825. Add. 1825.1

Fishes, p. 627–661.

— *A history of the earth and animated nature.* 2 vols. Glasgow, Edinburgh, & London, 1858. illust. Add. 1858.1

Fishes, vol. ii, p. 269–325. figs. & pls.

Goll, J. Hermann. *L'existence du véron (*Phoxinus laevis*) dans le lac du Grand-Saint-Bernard.* *Arch. Sci. Phys. Nat.*, 1893, **30**, 646. Add. 1893.1

Golovine, E. *Sur le périblaste des poissons osseux.* *Bull. Acad. Sci. St. Petersburg*, 1898, 5. ser., **9**, 345–368. Add. 1891.1

— *Études sur les cellules pigmentaires des vertébrés.* *Ann. Inst. Pasteur*, 1907, **21**, 858–881. pl. Add. 1907.1

Translation of Golovin, E., 1907.1.
Structure of melanophores of various fishes studied.

Gomes, Edwin H. *Seventeen years among the sea dyaks of Borneo.* London and Philadelphia, 1911, 343 p. 40 ill. 8°. Add. 1911.1

Fishing with floats, hooks, and casting net, p. 54; with the tuba root (*Cocculus indicus*), p. 55–56.

Gonzaga, Carlo A. V. *Il pescatore italiano in Oriente.* *Neptunia, Venezia*, 1904, **19**, 65–68. Add. 1904.1

Eastern Mediterranean and shores of Turkey.

Goode, George Brown [1851–1896] For biography and works see in Vol. I. Jordan, D. S. 1897.1. Also *Amer. Journ. Sci.*, 1896, **2**, 313–314. — *Amer. Naturalist*, 1896, **30**, 866–868. — *Anthrop. (Paris)*, 1896, **7**, 724. — *Auk*, 1896, **13**, 349. — *Science*, 1896, **4**, 365–366, 661–668. *Ibid.*, 1897, **5**, 365–378. — *Ibis*, 1897, **3**, 147. — *Rept. Smithson. Inst.*, 1897, pt. 2, 1–61. — *Bull. Washington Phil. Soc.*, 1900, **13**, 396–399.

— The identity of *Rhinonemus caudacuta* (Storer) Gill, with *Gadus cimbrius* Linn. *Proc. U. S. Nat. Mus.*, 1878 (1879), **1**, 348–349. Add. 1879.1

— Plan of inquiry into the history and present condition of the fisheries of the United States. *Rept. U. S. Fish Comm.* 1880 (1883), **8**, 3–52. Add. 1883.1

— The color of fishes. *Trans. Amer. Fisheries Soc.*, 1889, 65–75. Add. 1889.1

Goode, George Brown, & Collins, J. W. *The fresh halibut fishery (In The fisheries and fishery industries of the United States, edited by George Brown Goode, Sect. 5, vol. i, p. 3–89. 22 pls. 1887)* Add. 1887.1

Goode, G. B., & Kilbourne, S. A. See **Kilbourne & Goode.**

Gordon-Cumming, Constance Fred-erica. *A lady's cruise in a French man-of-war.* New ed. Edinburgh & London, 1882. xii, 362 p. illust. Add. 1882.1

Fishes, supply, chap. 7, p. 86–87.
Fishing, spearing and netting fishes, noosing and "tickling" sharks, chap. 15, p. 213–219.

— Wanderings in China. London, 1887. Add. 1887.1

Fishing with the cormorant, p. 101-102; with the otter, p. 103.

Gorjanovič-Kramberger, Dragutin [= Karl] Ueber Fr. Bassani's "Ricerche sui pesci fossili di Chiavon." Verh. Geol. Reichanst. Wien, 1889, 86-89. Add. 1889.1

Gorka, Sándor. Az állatok psychikai életéről. Allatt. Közlem. Köt., 1902, 1, 62-72; 104-113; 137-148. 8 figs. Add. 1902.1

"Ueber die Psyche der Tiere."

Goronowitsch, N. Vorläufige Mittheilung über die Entwicklung des Centralnervensystems bei Knochenfischen. Zool. Anz., 1884, 7, 270-272. Add. 1884.1

Gortner, R. A. Chemistry of ontogeny. 12. Yearbook Carnegie Instit. Washington, 1913, no. 12, 106-107. Add. 1913.1

Syntheses of proteins and elective combustion of N fractions demonstrated in trout eggs.

Gosse, Philip Henry [1810-1888] For biography and works, see Auk, 1888, 5, 446-447. — Entomologist, 1888, 21, 264. — Humboldt, 1888, 7, 447. — Leopoldina, 1888, 24, 171-172. — Midland Naturalist, 1888, 11, 297-302. — Proc. Roy. Soc., 1888, 44, xxvii-xxviii. — Zoologist, 1888, 12, 382-383. — Amer. Micr. Journ., 1889, 10, 92. — Canad. Ent., 1889, 21, 17-19. — Ent. Month. Mag., 1888-89, 25, 113-114. — Nat. Canad., 1889, 18, 81. — Proc. S. London Ent. Nat. Hist. Soc., 1888-89, 30-31. — Canad. Rec. Sci., 1891, 4, 368-369. — Geogr. Jahrbuch., 1891, 14, 211. — Journ. Jamaica Inst., 1899, 2, 574-581.

— The romance of natural history. Boston, 1864. 372 p. Add. 1864.1
Bony fishes, 75-88; sharks, 218-261.

— A year at the shore. London, 1865. 327 p. illust. Add. 1865.1
Notes on fishes.

Gostling, D. Fish leaving the water. Journ. Bombay Nat. Hist. Soc., 1894-95, 9, 494-495. Add. 1894.1

Goteh, Francis. The electrical discharge of *Malapterurus electricus*. Journ. Physiol., 1886, 7, xxvii-xxix. Add. 1886.1

— The electromotive properties of the electrical organs of *Torpedo mar-*

morata [Abstract]. Proc. Roy. Soc. London, 1887, 42, 357. Add. 1887.1

— Experiments on curarised torpedoes. Journ. Physiol., 1888, 9, vi-x. Add. 1888.1

— Further observations on the electrical organ of *Torpedo marmorata*. Proc. Roy. Soc. London, 1887-88 (1888) 43, 418-419. Add. 1888.2

— Electric organ in fishes. Midland Naturalist, 1889, 12, 171-172. Add. 1889.1

— [The discharge of *Malapterurus electricus*] Nature, 1895, 52, 556. Add. 1895.1

— The physiology of electrical organs. (In Schäffer, E. A., Text-book of Physiology, II, London, 1900, 561-591.) Add. 1900.1

Refers to *Raja batis*, *Gymnotus*, *Torpedo* and *Malopterurus*.

Gottberg, Gunnar. Studier öfver lakens (*Lota lota* L.) ålder, lek och födoamnen hos oss (Studien über das Alter, das Laichen und die Nahrung von *Lota lota* L. in Finland) Finlands Fiskerier, 1912, 1, 146-162. Add. 1912.1

Gould, A. A. (editor) [1805-1866] The naturalist's library, containing scientific and popular descriptions of man, quadrupeds, birds, fishes, reptiles and insects. New York, 1849. 880 p. illust. 8°. Add. 1849.1

Popular work of little value.

Gould, C. Mythical monsters. London, 1886. 407 p. pl. col. illust. Add. 1886.1

Gourret, Paul. Les appâts de pêche usités à Marseille. Rev. Marit. et Colon., 1893, 117, 427-443. Add. 1893.1

— Les pêcheries et les poissons de l'étang de Thau. Rev. Marit. et Colon., 1896, 129, 353-371, 577-591. *Ibid.*, 1896, 130, 161-175, 369-384. Add. 1896.1

Complete reference for Gourret, P. 1896.3.

— Les étangs saumâtres du midi de la France et leurs pêcheries. Ann. Mus. Hist. Nat. Marseille, 1897-99, 5, mém. 1. ix, 386 p. Add. 1897.1

Goyeau, — Von einem bei Ceuta gefangenen Seehunde. Hamburg Mag., 1760, 24, 531-548. Add. 1760.1

Graber, V. Grundlinien zur Erforschung des Helligkeit- und Farbensinnes der Tiere. Prag & Leipzig, 1884. Add. 1884.1

Experiments on color discrimination among fishes, pp. 126-132.

Grabowsky, F. *Ceratodus forsteri* Krefft. Jahresh. Ver. Naturwiss., Braunschweig, 1897, 10, 198. Add. 1897.1

Graells, Mariano de la Paz. Exposiciones internac. de pesca y agricultura de Arcachon y Boulogne-sur-Mer. Madrid, 1867. pl. Add. 1867.1

Gräper, Ludwig. Eine neue Anschauung über physiologische Zellausschaltung. Arch. Zellforsch., 1914, 12, 373-394. 3 figs. pls. Add. 1914.1

"Gelegentliches Vorkommen einer intercellulären Chromatolyse. Befunde am Dottersack von Acanthias."

Grancher, —. Usage, pour l'alimentation, des morues dites morues rouges; conditions dans lesquelles cet usage peut être ou non considéré comme nuisible. Rec. Trav. Comité Consult. Hyg. Pub. France, 1887, Paris, 1888, 17, 1-9. Add. 1887.1

Grant, W. De coitu et propagatione salmonis. Analect. Transalpin., [1762] 2, 422. Add. 1762.1

See also Grant, W. Pre-L. section 1752.1.

Grassi, Giovanni Battista. Contributo alla conoscenza delle uova e delle larve dei murenoidi (Aggiunta alla mia monografia sulle metamorfosi dei murenoidi) Mem. Accad. Lincei, Roma, 1914, 5. ser. 10, no. 4, 37-43. pl. Add. 1914.1

— Funzione respiratoria delle cosiddette pseudobranchie del Teleostei e altri particolari intorno ad esse. Bios, Genova, 1914, 2, 1-16. 3 pls. Add. 1914.2

Probranchia (pseudobranchia) equivale ad un foglietto branchiale.

Grassi, Leonardo. I pesci dei laghi di Ganzirri e Faro. Neptunia, Venezia, 1903, 18, 202-207; 213-219; 225-231. Add. 1903.1

Gray, John Edward [1800-1875] For bibliography, see Saunders, J. 1872.1

— Catalogue of the specimens and drawings of mammals, birds, reptiles and fishes of Nepal and Tibet, presented by B. H. Hodgson to the British

Museum. 2 ed. London, 1863. 90 p. 12°. Add. 1863.1

— Notice of a portion of a new form of animal (*Myriosteon higginsi*). Probably indicating a new group of Echinodermata. Proc. Zool. Soc. London, 1864, 163-166. Add. 1864.1

Describes *Myriosteon*. *M. higginsi* n. g. et n. sp. now considered a tube from the rostral cartilage of *Pristis*.

Gray, John Henry. China, a history of the laws, manners and customs of the people. Edited by W. G. Gregor. 2 vols. London, 1878. ills. 8°. Add. 1878.1

Chap. 30 deals with modes of fishing in China.

Greco, B. Sulla presenza del Dogger inferiore (Jurassic) al Monte Foraporta presso Lagonegro. Boll. Soc. Geol. Ital., 1899, 18. anno, 65-70. Add. 1899.1

Greeff, R. Ueber einen neuen Süßwasserfisch der Insel S. Thomé. Sitzber. Ges. Beförd. Gesamt. Naturwissensch. Marburg, 1882, no. 2, 37. Add. 1882.1

Describes *Gobius bustamantei*, n. sp. from St. Thomas Island, Gulf of Guinea.

Green, E. Ernest, Reeves, E. Gordon, & Willey, A. See **Reeves, E. Gordon, Willey, A., & Green, E. Ernest.**

Green, John [Presentation of and remarks upon the breeding habits of several species of fish from Surinam] Proc. Boston Soc. Nat. Hist., 1858, 6, 328. Add. 1858.1

Oral gestation described for catfishes of Surinam.

Green, Seth. For biographical sketch, See Trans. Amer. Fisheries Soc. 1910 (1911), 66-68.

— Description of improved apparatus in fish-hatching. Rept. U. S. Fish Comm. 1872-73 (1874), 2, 578. Add. 1874.1

Green, William Spotswood. The common sole. Nature, 1890, 42, 520. *Ibid.*, 1891, 43, 56. Add. 1890.1

Greene, Carl Hartley, & Greene, Charles Wilson. See **Greene, C. W., & Greene, C. H.**

Greene, Charles Wilson. The fat-absorbing function of the alimentary tract of the king salmon. Bull. U. S. Bureau Fisheries, 1913 (1914), 33, 149-175. 4 pls. Add. 1914.1

— The storage of fat in the muscular tissue of the king salmon and its resorption during the fast of the spawning migration. *Bull. U. S. Bureau Fisheries*, 1913 (1914), **33**, 69–138. 9 pls. Add. 1914.2

Greene, Charles Wilson, & Greene, Carl Hartley. The skeletal musculature of the king salmon. *Bull. U. S. Bureau Fisheries* 1913 (1914), **33**, 21–59. figs. Add. 1914.1

Gregg, W. H. Where, when, and how to catch fish on the east coast of Florida. New York & Buffalo, 1902. Add. 1902.1

Gregorio, A. Sulla fauna delle Argile scagliose di Sicilia e sul Miocene di Nicosia. *Pesci. Palermo*, 1881. 60 p. 3 pls. 4°. Add. 1881.1

Gregory, E. H. Origin of the elastic fibres in the heart and aorta of the Axolotl and the salmon trout. *Journ. Boston Med. Soc.*, 1897–98, **2**, 18–20. Add. 1897.1

Grenfell, Wilfred T. Labrador: the country and the people. New York, 1910. Add. 1910.1

Fisheries treated in some detail.

Greschik, Jenő. A kárász [Carassius] bélcsatornája, különös tekintettel a rugalmas rostokra [Der Darmkanal der Karausche, mit besonderer Berücksichtigung der elastischen Fasern] Allatt. *Közlem.*, 1914, **17**, 177–184. 3 figs. Add. 1914.1

German résumé, p. 222–223.

Greshoff, Maurits. Beschrijving der giftige en bedwelmende planten bij de vischvangst in gebruik. Tevens: Overzicht der heroische gewassen der geheele aarde en hunner verspreiding in de natuurlijke planten-familiën. (Monographia de plantis venenatis et sopientibus quæ ad pisces capiendos abhiberi solent). 3 parts. Batavia, 1893–1913. Add. 1893.1

i. Mededeelingen uit 's Lands Plantentuin, no. 10. 1893.

ii. *Ibid.*, no. 29. 1900.

iii. [Supplement] Mededeelingen Department Landbouw, no. 17. 1913. 370 p. An extensive and valuable treatise.

Grieg, J. A. Bidrag til kundskaben om Hardanger-fjordens fauna. *Bergens Museums Aarbok*, 1913, **1**. 147 p. 2 pls. Add. 1913.1

Pisces, p. 37–52.

Grieve, Sommerville. The common lump-fish. *Trans. Edinb. Nat. Soc.*, 1891, **2**, 413–416. Add. 1891.1

Griffen, S. Are sharks man eaters? New York, 1881. 24 p. Add. 1881.1

Griffin, Lawrence Edmonds. A guide for the dissection of the dog-fish. *Missouri Valley Coll. Quart. Bull.*, 1907, **6**, 1–65. Add. 1907.1

A fairly complete account of the anatomy of *Squalus*.

Griffith, —. Memorandum regarding *Salmo orientalis*, or Bornean trout. *Calcutta Journ. Nat. Hist.*, 1842–43 (1843), **3**, 283–284. Add. 1842.1

Grimble, Augustus. Shooting and salmon fishing: hints and recollections. London, 1892. 259 p. pls. Add. 1892.1

Salmon fishing, p. 175–259.

— The salmon rivers of Scotland. 3. ed. London, 1913. 326 p. 8°. Add. 1913.1

Grimm, J. D. Ein Beitrag zur Anatomie des Darmes. Inaug. Dissert., Dorpat, 1866. 47 p. 3 pls. Add. 1866.1

Grimm, O. von. Fishing and hunting on Russian waters. (In the literature of the Great International Fisheries Exhibition, 1883. London, 1883. 8°.) Also separate, St. Petersburg, 1883. 55 p. 8°. Add. 1883.1

Grimshaw, Beatrice. In the strange south seas. London, 1907. 381 p. illust. Add. 1907.1

"Tickling" and noosing sharks, p. 135–136; habits of sharks, p. 217, 254–263; trolling with pearl shell hook, p. 237; diving and trolling, p. 249; fishing with net, p. 323.

Gronovius, Laurentius Theodorus [1730–1778] Van den Siddervis of Beef-Aal. [Gymnotus] Uitgezogte Verhandeling, 1758, **3**, 468–478. Add. 1758.1

— Animalium in Belgio habitantium. *Acta. Helvet.*, 1760, **4**, 243–270. *Ibid.*, 1762, **5**, 120–153; 353–382. Add. 1760.1

— Bibliotheca regni animalis atque lapidei, seu recensio auctorum et librorum, qui de regno animali & lapideo . . . in usum naturalis historiæ studiosorum, etc. *Lugduni Batavorum* (Leyden), 1760. Add. 1760.2

Gronovius, L. T.

— *Animalium rariorum fasciculus. Pisces. Acta. Helvet.*, 1778, 7, 43–52.

Add. 1778.1

Describes *Pteraclis pinnatus*, *Blennius torvus*, and *Callorhynchus americanus*.

Gronovius, Jo. Frid. Vom Schlammbeisker. *Cobitis fossilis*. Berlin. Samml., 1775, 7, 645.

Add. 1775.1

Groos, Karl (Baldwin, E. L., translator) The play of animals. New York, 1898.

Add. 1898.1

Fishes, p. 100, 102, 219, 265.

See also Groos, K. 1902.1.

Groshans, G. P. F. Prodrromusfaunæ Homeri et Hesiodi. fasc. 1 & 2. 1839–43.

Add. 1839.1

Reference from Moulé, L. "Etudes zoologiques et zootechniques dans la littérature et dans l'art. La faune d'Homère." Mém. Soc. Zool. France, 1909, 22, 186.

Grosier, —. De la Chine: description générale de cet empire; contenant e. a. les trois règnes de son histoire naturelle. 3. éd. 7 vols. Paris, 1818–20. maps. 8°.

Add. 1818.1

Gross, Julius. Description of carp ponds and water gate. Bull. U. S. Fish Comm., 1886, 6, 303–304. 4 figs.

Add. 1886.1

Grossinger, Ker. János. Universa historia physica regni Hungariæ, secundum tria naturæ regna digesta. 5 vols. Posonii & Comaromii, 1793–97. 8°.

Add. 1793.1

Vol. III. "Historia piscium et amphibiorum Hungariæ," xiv, 400 leaves.

Grotewold, C. Die deutsche Hochseefischerei in der Nordsee. Stuttgart, 1908. 298 p. 75 illust. 8°.

Add. 1908.1

Grotrian, —. Handbuch für Fischer und Fischerei-aufsichtsbeamte der Provinz Posen. Im Auftrage des Fischerei-Vereins für die Provinz Posen zusammengestellt. 2. Auflage. Gnesen, 1905. 82 p. 12°.

Add. 1905.1

Grünberg, V. *Alburnus chalcoides* und *Abramis vimba* im Stromgebiet des Kuban-Flusses [Text in Russian] Vešt. Rybopromyšl, Petrograd, 1914, 28, 242–251.

Add. 1914.1

— Beiträge zur Biologie der Acipenseriden im Kuban-Flusse. [Text in Russian] Vešt. Rybopromyšl, Petrograd, 1914, 28, 219–227.

Add. 1914.2

Gruvel, A. Les campagnes d'hiver des pêcheurs Bretons sur les côtes de Mauritanie et du Sénégal. Bull. Trim. Enseign. Pêches Maritimes, Paris, 1913, 18, 274–280.

Add. 1913.1

Gubareff, P. M. Description of the poisonous fish fuku [Text in Russian] Med. Pribav. K. Morsk. Sborniku, St. Petersburg, 1882, no. 9, 62–66.

Add. 1882.1

Gudernatsch, J. F. The structure, distribution, and variation of the thyroid gland in fish. Journ. Am. Med. Assoc. 1909, 54, 227.

Add. 1909.1

Gudger, E. W. [1866–] George Marcgrave, the first student of American natural history. Pop. Sci. Monthly, 1912, 81, 250–274. 5 figs.

Add. 1912.1

Reproduces figures and descriptions of fishes of Brazil. Contains an extensive bibliography.

— Summary of work done on the fishes of Tortugas. 11. Yearbook Carnegie Instit. Washington, 1912, 148–150.

Add. 1912.2

Structures and habits of the nurse shark, *Ginglymostoma cirratum*.

— Gestation (uterine) in the nurse shark, *Ginglymostoma cirratum*. Journ. Elisha Mitchell Sci. Soc., 1913, 29, 8.

— Science, 1913, n. s. 38, 993.

Add. 1913.1

— George Marcgrave, a postscript. Science, 1914, n. s. 40, 507–509.

Add. 1914.1

— The nurse sharks (*Ginglymostoma*) of Boca Grande Cay, Florida. Journ. Elisha Mitchell Sci. Soc., 1914, 30, 63–64.

Add. 1914.2

— Summary of work on the fishes of Tortugas. 13. Yearbook Carnegie Instit. Washington, 1914, 203–204.

Add. 1914.3

Güldenstaedt, Anton Johann. Appendix observationum ad historiam reliquorum cyprinotum cirratorum pertinentium. Act. Acad. Petropol., 1778, pt. 2, Mém. 253.

Add. 1778.1

i. De carpione. ii. De gobione. iii. De tinca.

Guénaux, Georges. Pisciculture. Introduction par P. Reynard. Préface par Charles Delonde. Paris, 1910. 489 p. illust. 12°.

Add. 1910.1

Günther, Albert (C. L. G.) [1830–1914] For biographical sketches see

McIntosh, W. C. in *Nature*, 1914, **92**, 664-666; Scotsman, Feby. 2, 1914; Proc. Roy. Soc. Edinb., 1914, **34**, 269-277; Proc. Roy. Soc. London, 1915, **88B**, xi-xxvii. pl. For an obituary, see Smith, E. A. *Zoologist*, 1914, **18**, 113-116.

— Ray (Raja) (In *Encyclopedia Britannica*, 9. ed., 1866, xx, 300. figs.) Add. 1866.1

— Musical fishes. *Sci. Gossip*, 1870, 97-98. Add. 1870.1

— The voyage of the "Vettor Pisani." *Nature*, 1884, **30**, 365. Add. 1884.1

Capture of the whale shark, *Rhineodon typus* at Panama.

— Fishes (In Aitcheson, J. E. T. *Zoology of the Afghan delimitation commission*) *Trans. Linn. Soc.*, 1888-94, 2. ser. **5**, 106-109. Add. 1888.1

— List of the species of reptiles and fishes collected . . . on the Upper Yang-tze-kiang and in the province Sze-chuen, with description of the new species. (In Pratt, A. F. *To the snows of Tibet through China*. London, 1892 appendix ii. 8°.) Add. 1892.1

— Rediscovery of the tile-fish ("Lopholatilus"). *Nature*, 1897-98, **57**, 53. Add. 1897.1

Günther, Hanns. *Biotechnik*. Kosmos, Stuttgart, 1914, 11. Jahrg., 131-133; 229-231. 12 figs. Add. 1914.1
Luftdruckmesser einer Heringsart bei Karpfen und Schlammpeitzger.

Guérin-Méneville, F. Ed. *Magasin de zoologie, d'anatomie comparée et de paléontologie* par F. Ed. Guérin-Méneville. Première et deuxième série avec des tables méthodiques et alphabétiques. 15 parts. Paris, 1831-45. 1085 pls. 8°. Add. 1831.1

Guerne, Jules de. *La nourriture de la sardine*. *La Nature*, 1887. 15. Ann., 1. Sem., 362-364. 6 figs. Add. 1887.1

See also Pouchet & Guerne, 1887.1.

Guettard, Jean Etienne. *Mémoire sur les glossoptérés ou dents de requins fossiles*. (In his *Mémoires sur différentes parties de la physique, de l'histoire naturelle des sciences et des arts*. 5 vols. Paris, 1768-1783. illust. 4°.) Add. 1768.1

Guichenot, Alphonse. *Les poissons (de l'Abyssinie)* (In *Voyage en Abys-*

sinie, exécuté pendant . . . 1839-43, par une commission scientifique composée de MM. T. Lefebvre . . . A. Petit et Quartin-Dillon, etc. 6 vols. & atlas. Paris, 1845-51. 8° & fol.) Add. 1847.1

Poissons, pt. iv, vol. VI, 1847, p. 227-238.

— *Ichthyologie*. I. *Le Trigle polyommate*, nouveau genre de poisson de la famille des Trigloides. II. *Le Zancle centrognathe*, nouveau genre de Che-todons. III. *L'Argentine leiglosse*, nouveau genre de Salmonides. *Ann. Soc. Linn. Départ. Maine-et Loire*, 1867, **9**, 9-17. Add. 1867.1

Guillard, —, & Aignan, — See Aignan & Guillard.

Guillemard, F. H. H. *The cruise of the Marchesa to Kamchatka and New Guinea*, etc. New York, 1889. 455 p. illust. Add. 1889.1

Salmon in Kamchatka, pp. 91-99; 104.

Guillemard, N. *La pêche à la ligne et au filet dans les eaux douces de la France*. Paris, 1857. 348 p. 2 pls. Add. 1857.1

Guillot, Natalis [1802-1866] *Exposition anatomique de l'organisation du centre nerveux dans les quatre classes d'animaux vertébrés, &c.* *Mém. Acad. Roy. Sci. Brussels*, 1844, **16**, 369 p. 18 pls. 4°. Add. 1844.1

Guimaraes, Antonio Roberto Pereira. *Fish*. (In Capello, H. C. de B., & Ivens, R. *From Benguela to the territory of Yacca. Description of a journey into Central and West Africa* . . . in . . . 1877-1880. Translated by A. Elwes. 2 vols. append. London, 1882. illust. 8°.) Add. 1877.1

Guiscardi, G. *Annotazioni paleontologiche*. *Atti R. Accad. Sci. Fis. Mat. Napoli*, 1873, **5**, no. 16, 1-5. pl. Add. 1873.1

Records *Diodon scillæ* Ag. from Miocene of Lecce Prov.

Guitel, Frédéric. *Sur les bourgeons musculaires des nageoires paires du Cyclopterus lumpus*. *C. R. Acad. Sci. Paris*, 1894, **118**, 877-881. Add. 1894.1

— *La baudroie se nourrit-elle de proies vivantes?* *La Nature*, 1913, 41. Ann., 2. sem., 164-166. 2 figs. Add. 1913.1

— *Contribution à l'étude d'une larve de Polypterus senegalus* Cuvier.

Guitel, F.

Arch. Zool. Paris, 1914, **54**, 411-437.
2 pls. Add. 1914.1

Gulia, Giovanni. Uno sguardo alla zoologia delle isole Maltesi. C. R. 9. Congr. Intern. Zool. Monaco, 1913 (1914), 545-555.

Refers to works on the ichthyology of Malta.

Gundersen, H. Drying codfish at Bordeaux. Bull. U. S. Fish Comm. 1886, **6**, 84-86. 4 figs. — Norsk Fiskeritidende, 1886, **5**. Add. 1886.1

Gunn, T. E. A catalogue of the . . . collection of British sea and freshwater fish and fish-eating birds, also animals and reptiles, exhibited . . . by T. E. Gunn, &c. (Great Internat. Fisheries Exhib. London, 1883) Norwich, 1881. 20 p. pl. 12°. Add. 1881.1

Gunner, Johann Ernst [1718-1773] For a memorial volume, see "Johann Ernst Gunnerus. 1718—26. Februar — 1918." Mindelblade utgit af Kongelige Norske Videnskabers Selskab. Trondhjem, 1918. 143 p. portr. & figs.

— Fishes and fishing among the Lapps of Finmarken (In Leem, Canute, De Lapponibus Finmarchiæ, etc. Hafniæ, 1767. ill. 4°.) Add. 1767.1

— Videre oplysning om brugden (*Squalo maximo*). Samt breviss at denne, ersteral formodning, har vaeret den fisk, som opfluede profeten Jo-

nas. K. Norsk. Vidensk. Selsk. Skrift., Kjøbenhavn, 1768, **4**, 14-37.

Add. 1768.1

Guppy, H. B. The Solomon islands and their natives. London, 1887. 384 p. illust. Add. 1887.1

Fishing methods, kite, float, spear, nets, spider's web, hooks, poison, p. 151-158. Fish eating large snails, p. 337.

Gurley, Revere Randolph. On the classification of the Myxosporidia, a group of protozoan parasites infesting fishes. Centralb. Bakteriöl. Parasitenk., Jena, 1894, **15**, 86-88. — Journ. Roy. Micr. Soc., London, 1894, 465.

Add. 1894.1

Review and abstract of Gurley, R. R., 1893.1

Gurney, J. H. Gannet choked by a gurnard. Zoologist, 1914, 4. ser. **18**, 150-151. fig. Add. 1914.1

Guth, Ernst. Ueber die directe motorische Wirkung des Lichtes auf den Sphincter pupillæ des Aal- und Froschauges. Arch. Gesammt. Physiol., 1901, **85**, 119-142. Add. 1901.1

Guthe, H., Metzger, A., & Zuchold, E. v. (editors). See **Zuchold, Guthe, & Metzger.**

Guyon, — Note sur les accidents qu'on observe quelquefois, sous les tropiques, par suite de l'ingestion du poisson. C. R. Acad. Sci. Paris, 1856, **42**, 2. sem., 340. Add. 1856.1

Effects of eating poisonous flesh of various fishes.

H

H., — Korte aantekeningen (zeevischerij) Tijdsch. Vereen. Nederl., 1905, 4. jaarg., 343-345. Add. 1905.1

Haack, H. Fischzucht. Deutschland, Oesterreich-Ungarn, Holland, Russland, Schweden, Norwegen, Dänemark. Intern. Fischerei-Ausstell., Berlin, 1880. Amtliche Berichte no. 1. Berlin, 1881. 8°. Add. 1881.1

Haacke, Wilhelm. Ueber das Zahlen-Verhältnis der Geschlechter bei Haien und Rochen. Zool. Garten Frankfurt, 1885, 26, 246-248. Add. 1885.1

— Polyembryonale Brutkapseln bei Haien und Rochen. Kosmos, 1886, 18, 238-239. Add. 1886.1

Haddon, Alfred Cort [1855-] On the stridulating apparatus of *Callomystax gagata*. Journ. Anat. Physiol., 1881, 15, 322. Add. 1881.1

— Zoological notes from Torres Straits. Nature, 1888-89 (1889), 39, 285-286. Add. 1889.1

i. Caudal respiration in *Periophthalmus*.
ii. The employment of the suckerfish (*Echeneis*) in turtle-fishing.
iii. *Amphioxus*.

— The decorative art of British New Guinea: a study in Papuan ethnography. Cunningham Memoirs, no. 10, 1894. 277 p. 12 pls. & 92 text figs. Add. 1894.1

The fish motif, p. 22-25.

— Head-hunters, black, white and brown. London, 1901. 426 p. 31 pls. & 40 text-figs. Add. 1901.1

Tuba-fishing in Sarawak, p. 324; 406-409.
Fishing with the remora in Torres Straits, p. 155-157.

— Reports Cambridge Anthropological Expedition Torres Straits. 6 vols. Cambridge, 1904-12. Add. 1904.1

These volumes are full of references to fishes showing what a great part they play in the lives of the people of Torres Straits. The following are of especial value:

i. 1904. Vol. V. Fishing with the remora, p. 44-46; 67; 92; 109; 115; 336. Hammerhead shark myth, p. 64. Magic in connection with fishing, p. 330-345.

ii. 1908. Vol. VI. Fishing with the remora, p. 4. fig.; p. 41-42. Charms for fish, p. 217.

iii. 1912. Vol. IV. Fishing with hooks, traps, spears, torches, bows, wiers, poison, p. 154-159; with the remora, p. 162-166. figs., p. 221. fig. Fishes in decoration, p. 348-353. 25 figs.

Haddon, A. C., & Rivers, W. H. R. Totemism (In Repts. Cambridge Anthropol. Exped. Torres Straits, vol. v, Western islanders. Cambridge, 1904) Add. 1904.1

Fish totems, p. 154-157.

Hadfield, Henry. Food of the basking shark and herring. Zoologist, 1885, 3. ser. 9, 352. Add. 1885.1

Haeckel, Ernst. Die Gastrula und die Eifurchung der Tiere. Jena. Zeitschr. Naturw., 1875, 9, 402-508. 5 pls. Add. 1875.1

Described in *Gadus* and *Motella*.

Haempel, Oskar. Fische (In Hilzheimer, M. Handbuch der Biologie der Wirbeltiere. Stuttgart, 1913. 754 p. 599 figs.) Add. 1913.1

Fische, p. 1-176. 55 figs.

i. Review of general anatomy and physiology.

ii. Dependence on physico-chemical environment.

iii. Relation to their organic environment. Apparently identical with Haempel, O., 1912.1.

— Fischzucht und deren Bedeutung für das wirtschaftliche Leben. Schrift. Ver. Verbr. Nat. Kenntn., Wien, 1914, 54, 155-182. pl. Add. 1914.1

— Ueber Altersbestimmung und Wachstum des Aales (*Anguilla vulgaris*) Verh. Ges. Deutsch. Nat. Aerzte, 1914, 85. Vers., 2 Teil, 1. Hälfte, 711-712. Add. 1914.2

Einpfündige Aale befinden sich bereits im 10. oder 11. Jahre ihres Aufenthaltes im Süßwasser.

Haempel, O., & Kolmer, W., Ein Beitrag zur Helligkeits- und Farbenanpassung bei Fischen. Biol. Centralbl., 1914, 34. Jahrg., 450-458. Add. 1914.1

Reaktion einer Pfrillengruppe auf gelbem und rotem Untergrund nicht nur durch Hellfärbung, sondern auch durch deutliche Gelb- und Rotfärbung.

Häpke, L. Das Weserwehr bei Bremen und seine Fischpässe. Himmel

Häpke, L.

und Erde, 1913, 25. Jahrg., 173-179.
4 figs. Add. 1913.1

Haffner, Carl. Die Aalquappe im Aquarium. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 763-764. 3 figs. Add. 1914.1

Halkett, Andrew. The red Canadian trout (*Salvelinus marstoni*) Natural. Canad., 1914, 41, 3-4. Add. 1914.1

Hall, James. Geology of New York. Part iv, comprising the survey of the 4th geological district. Albany, 1843, xxv, 687 p. 19 pls. tables. 4°. Add. 1843.1

Describes *Sauripteris taylori*, p. 282.

Haller, Alb. v. De cerebro avium et piscium. Over de Hersenen der Vogelen en Visschen. Verh. Holl. Maatsch. Wet. Haarlem, 1768, 10, st. 2, 287-386. Add. 1768.1

— Bibliotheca anatomica qua scripta ad anatomiam et physiologiam facientia a rerum initiis recensentur. 2 vols. Tiguri, 1774 & 1777. 816 & 870 p. Add. 1774.1

Haller, Béla. Beiträge zur Anatomie und Physiologie von *Luvarus imperialis* Raf. I. Zur Anatomie und Histologie [Muskulatur, Verdauungsapparat, und Gehirn] (In Krukenberg, C. Fr. W. Vergl. Physiol. Studien Adria. Heidelberg, 1881, 1, 4. Abth., 3-20. 3 pls.) Add. 1881.1

— Bemerkungen zu Professor van Gehuchten's Kritik über [die Arbeit des Verfassers]: "Untersuchungen über das Rückenmark der Teleostier." Zool. Anz., 1896, 19, 245-249. Add. 1896.1

— Ueber die Abstammung der Ossa supracleithralia von der Epidermis bei der Forelle. Arch. Mikr. Anat., 1914, 84, 1. Abth., 446-452. pl. Add. 1914.1

Haller, D. Von der Natur und Eigenschaft der Fische, und welchen Leuten sie gesund sind. Arch. Fischereigesch., 1914, 2. heft, 138-141. Add. 1914.1

Reprint (in part) of Anon. 633.

Halliday, Andrew. The West Indies: the natural and physical history of the Windward and Leeward islands. London, 1837. Add. 1837.1

Incidental notes on fishes, p. 62; 235-236; 345.

Hallock, Charles. The fishing tourist. Angler's guide and reference book. New York, 1873. 239 p. 12°. Add. 1873.1

— The salmon fisher. New York, 1890. 126 p. 16°. Add. 1890.1

Hallstrom, G. Kolalapparnas hotade existens [Lachs- und Binnensee-fischerei der Kolalappen] Ymer. Tidskr. Svensk. Sällskap. Antropologi & Geografi, 1911, 31, 239-316. Add. 1911.1

Halterbeck, J. Von dem heutigen Stand der Aquarium und Terrarienkunde in Nordamerika. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 657-658. Add. 1914.1

Haly, Amygrald. On *Rhinodon typicus* Smith. Rept. Colombo Mus. 1883 (Ceylon Administration Repts. 1883 (1884), 129 D-130 D) Add. 1884.1

— Fish new to Ceylon and India. Taprobanian, 1887, 2, 169. Add. 1887.1

— Occurrence of a species of *Xiphias* in Ceylon. Taprobanian, 1887, 2, 11. Add. 1887.2

— On *Rhinodon typicus* Smith. Rept. Colombo Mus. 1889 (Ceylon Administration Repts. 1889 (1890), 14) Add. 1890.1

— A medium for preserving the colours of fish and other animals. Nature, 1892, 45, 212. Add. 1892.1

Hamel, Egbert D. [*Argulus foliaceus*] a parasite of fish. Zoologist, 1870, 2. ser. 5, 2185. Add. 1870.1

Hamilton, A. Deep-sea fauna of New Zealand. Wellington, 1896. 29 p. map. Add. 1896.1

Extracted from reports of the "Challenger" expedition.

Hamilton, Edward. Recollections of fly fishing for salmon, trout and grayling, with notes on their haunts, habits and history. New York, 1885. xi, 190 p. illust. 12°. Add. 1885.1

Second ed., London, 1891. First published, London, 1884.

Hamilton, E., Lankester, E. R., & Day, Francis. See **Lankester, Day, & Hamilton.**

Hamilton, Hugh. The Susquehanna river lamprey. Rept. Dept. Fisheries Pennsylvania 1911-12 (1913), 70-76. Add. 1913.1

Hammer, Julius. *Rasbora heteromorpha*, Keilfleckbarbe. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 514-515. fig. Add. 1914.1

Hankin, E. H. Animal flight; a record of observation. London, 1914. viii, 405 p. 98 figs. 8°. Add. 1914.1
The flight of flying fishes, p. 227-250.

Hankinson, T. L. Field problems on stream fishes for secondary classes. School Sci. & Math., 1909, 9, 234-240. Add. 1909.1

— Distribution of fish in streams about Charleston, Illinois. Trans. Ill. State Acad. Sci., 1913, 6, 102-113. Add. 1913.1

— Young whitefish in Lake Superior. Science, 1914, n. s. 40, 239-240. Add. 1914.1

Hanow, Michel Christopher. Einige Besonderheiten an den Bressemen. Neue Ges. Erzähl. Liebhaber Naturlehre, 1761, 4, 303. Add. 1761.1
Cyprini are considered.

— Wahrscheinliche Erklärung eines sonderbaren Fisches [Lophius] (In Titius, J. D., Gemeinnützliche Abhandlungen, 1768, Th. 1, 275-283.) Add. 1768.1

Hanriot, M. Sur la mode d'action de la téphrosine [a fish poison] C. R. Acad. Sci. Paris, 1907, 144, 651-653. Add. 1907.1

— Sur la toxicité [for fishes] des principes définis du *Tephrosia vogelii* (Légumineuse) C. R. Acad. Sci. Paris, 1907, 144, 498-500. Add. 1907.2

— Sur les substances actives de *Tephrosia vogelii* [as a fish-poison] C. R. Acad. Sci. Paris, 1907, 144, 150-152. Add. 1907.3

Harald, — Eier vom australischen Molchfisch [Neoceratodus] (nach R. Semon) Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 800-801. Add. 1914.1

— Vom australischen Molchfisch *Ceratodus* (Neoceratodus) nach Berichten von R. Semon. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg. 635-636. fig. Add. 1914.2

Hardy, J. J. Salmon fishing. London, 1907. 182 p. illust. 8°. Add 1907.1

Hardy, Norman H., & Elkington, E. Way. The savage south seas [British New Guinea, Solomon islands, New Hebrides] London, 1907. 204 p. illust. Add. 1907.1

Fishing in New Guinea, p. 62-64; in the Solomon islands; for the bonito, 114-115; with the kite, 116; with nets, 117; with the spider's web net, 117; with the spear, 118; in the New Hebrides, 181.

Hargreaves, T. Sidney. The fishes of British Guiana. Demerara, 1904, viii, 36 p. 14 pls. Add. 1904.1

Harley, John. Description of two species of *Cephalaspis*. Quart. Journ. Geol. Soc., 1859, 15, 503-505. Add. 1859.1

Harmes, Thomas. Remarks on the very different accounts that have been given of the fecundity of fishes, with fresh observations on that subject. Phil. Trans. Roy. Soc., 1767 (1768), 57, (pt. 2), 280-292. Add. 1768.1

Eggs weighed and counted.

Harms, W. Ueber die Augen der am Grunde der Gewässer lebenden Fische. Zool. Anz., 1914, 44, 35-41. 5 figs. Add. 1914.1

Vorkommen einer "Brille."

Haro, A. Notice anatomique sur le squalé bleu. Mém. Acad. Roy. Metz, 1839, ann. xx. 21 p. 8°. Add. 1839.1

Harrell, J. Dock. Trapping gaspereau in Tangipahoa river. Bull. U. S. Fish Comm. 1884, 4, 448. Add. 1884.1

Harriott, John. Struggles through life, etc. 2 vols. London & Philadelphia, 1809. Add. 1809.1

Rain of fishes, vol. 1, p. 141-142.

Harris, Thaddeus Mason. The natural history of the Bible; or description of all the quadrupeds, birds, fishes, reptiles, and insects, trees, plants, flowers, gums, and precious stones, mentioned in the Sacred Scriptures. London, 1824. 8°. Add. 1824.1

Harris, W. C. (compiler) The angler's guide book and tourists' gazetteer of the fishing waters of the United States and Canada. New York, 1885. 249 p. 12°. Add. 1885.1

Harrison, Ross G. The metamorphism of the dorsal and ventral longitudinal muscles of the teleost. Johns Hopkins Univ. Circ., 1894, 13, 62-63. Add. 1894.1

Hart, Henry Chichester. Scripture natural history. II. The animals mentioned in the Bible. London, 1888. 240 p. illust. Add. 1888.1

Fishes, p. 94-99.

Hart, H. Martyn. The world of the sea, translated and enlarged from Moquin-Tandon, C. H. B. A., Le monde de la mer. London 1882.

Add. 1882.1

Fishes, p. 319-356.

Hartel, Ernst. Aus den Wanderjahren eines Naturforschers. Reisen und Forschungen in Afrika, Asien und Amerika, etc. Berlin, 1901-02. xv, 329 p. illust. Add. 1901.1

Fische, p. 5; 265; 299.

Harting, J. E. Recreations of a naturalist. London, 1906. 433 p. illust. 12°. Add. 1906.1

The oldest book on fishing, p. 225-229. Fishes caught by bladderwort, p. 230-233. Fish-eating bats, p. 234-246.

Hartmann, —. Vom Fischbrod. Naturforscher, 1785, 21. Stück, no. 9.

Add. 1785.1

Hartwig, George. The sea and its living wonders; a popular account of the marvels of the deep, etc. 4 ed., London, 1873. Add. 1873.1

Fishes, p. 186-242.

— Denizens of the deep, an account of the fishes, mollusks, crustacea, etc. London, 1887. Add. 1887.1

An abridgement of "The sea and its living wonders," 4. ed., 1873.

For German edition, see Hartwig, G., 1857.1

Hartzer, Fernand. Les îles blanches (des archipels Gilbert et Ellice) des mers du sud. Paris, 1900, 345 p.

Add. 1900.1

Diodon skins used as helmets, p. 85, figs. on p. 85 and to face 248. Noosing sharks, p. 156.

Harvey, J. B. (Notice of the occurrence of the red band-fish (*Cepola rubescens*) near Teignmouth) Proc. Zool. Soc. London, 1838, p. 45-46.

Add. 1838.1

Harvey, W. H. The seaside book, an introduction to the natural history of the British coasts. London, 1857. 324 p. 83 figs. Add. 1857.1

"On fish and fish diet," by Wm. Yarrell, p. 237-269.

Harvie-Brown, J. A., & Buckley, Thomas E. See **Buckley & Harvie-Brown.**

Harvie-Brown, John Alexander & Murie, James. See **Murie & Harvie-Brown.**

Harz, C. O. On manufactured food for trout and carp. Bull. U. S. Fish Comm. 1884, 4, 449-452.

Add. 1884.1

Hase, Albrecht. Die Fische der deutschen Grenzexpedition 1910 in das Kaiser-Wilhelms-Land, Neu-Guinea. Jena. Zeitschr. Nat., 1914, 51, 525-547. 16 figs. Add. 1914.1

Descriptions are given of four new species of *Corvina*, *Boleophthalmus*, *Eleotris* and *Copidoglanis*.

Haslope, P. L. Practical sea-fishing. London, 1905. 282 p. illust. 8°. Add. 1905.1

Hasselt, Alexander Wilhelm Michael van. Allgemeine Giftlehre und die Gifte des Pflanzenreichs für Chemiker, Aerzte, Apotheker und Gerichtspersonen (translated from the Dutch by Dr. J. B. Henkel) Braunschweig, 1862. xii, 440 p. 8°. Add. 1862.1

Vol. ii, Fische, 78; Fischgift, p. 85; Fischstacheln, p. 426-429.

— Volksbeschryving van Midden-Sumatra (text & plates). 2 vols. Leiden, 1882. roy. 8°. Add. 1882.1

Hunting and fishing, p. 414-429.

Fishing implements, plates 124-128.

Hastings, C. Illustrations of the natural history of Worcestershire. Public. Worcestershire Nat. Hist. Soc., 1834. iv, 184 p. map. Add. 1834.1

Appendix B. Fish of the Avon.

Haswell, William Aitcheson. Note on the claspers of *Heptanchus*. Proc. Linn. Soc. New South Wales, 1884, 9, pt. 2, 381-382. pl. Add. 1884.1

— Jottings from the biological laboratory of Sydney University. 13. Note on *Urolophus testaceus*. Proc. Linn. Soc. New South Wales, 1889, 2. ser. 4, 1713-1716. Add. 1889.1

Viviparity in *Urolophus*, *Trygon*, and *Pristiophorus*.

— On the development of *Chilobranthus rufus* (Teleostei, Symbranchidæ). Rept. Aust. Assoc. Adv. Sci., 1890, 482-487. Add. 1890.1

— On a cestode of *Cestracion*. Centralb. Bakt. Parasitenk., Jena, 1904, 34 (pt. 1), 720-721. Add. 1904.1

Review of Haswell, W. A., 1902.1

— [Exhibition of six deep-sea fishes from off Sydney Heads] *Proc. Linn. Soc. New South Wales*, 1906, **31**, 565–566. Add. 1906.1

Hatschek, Berthold [1854–] *Mitteilungen über Amphioxus*. *Zool. Anz.*, 1884, **7**, 517–520. Add. 1884.1

— Ueber den Schichtenbau von *Amphioxus*. *Anat. Anz.*, 1888, **3**, 666. Add. 1888.1

— The *Amphioxus* and its development [translated and edited by James Tuckey] London, 1893. 181 p. 9 pls. Add. 1893.1

Haupt, Oskar. Beiträge zur Fauna des oberen Malm und der unteren Kreide in der argentinischen Cordillere. *Neues Jahrb. Mineral.*, 1907, Appendix **23**, 187–236. Add. 1907.1

Lepidotus maximus Wagner.

Hauschild, — Die soziale Lage der Besatzung der deutschen Hochseefischereifahrzeuge. *Fischerbote*, 1913, 5. Jahrg., 511–. Add. 1913.1

Hausmann, L. Ueber Trematoden der Süßwasserfische. *Rev. Suisse Zool.*, 1897, **5**, 1–42. pl. — *Centralb. Bakter. Parasitenk.* Jena, 1896, **19** (abth. 1), 389–392. — *Inaug. Diss.*, Genève, 1897, 42 p. pl. Add. 1896.1

Hautreux, Joseph Alfred. La pêche au Sénégal. *Mém. Soc. Sci. Bordeaux*, 1888, **4**, 339–352. figs. Add. 1888.1

Havenstein, — Das Fischereirecht der Mark Brandenburg. Berlin, 1903. Add. 1903.1

Hawkins, A. C. Lockatong formation of the Triassic of New Jersey and Pennsylvania. *Ann. N. Y. Acad. Sci.*, 1914, **23**, 145–176. pl. Add. 1914.1

Refers to Triassic ganoids.

Hawkins, Thomas. [Notes on Salmonidæ] *Mag. Nat. Hist.*, 1830, **3**, 94. Add. 1830.1

Hay, Oliver Perry [1846–] Some remarkable fossil fishes from Mount Lebanon, Syria. *Science*, 1903, n. s. **17**, 255. Add. 1903.1

Hayashi, H., & Muto, K. Ueber Atemversuche mit einigen Giften. Atemversuche mit Fugugift (Tetrodointoxin). *Arch. Exper. Pathol.*, 1901–02, **47**, 209–230. fig. Add. 1901.1

Heape, Charles, & Edge-Partington, James. See **Edge-Partington & Heape**.

Hébert, E. Tableau des fossiles de la craie de Meudon. *Mém. Soc. Géol. France*, 1854, 2. ser. **5**, 349–356. 10 figs. pls. Add. 1854.1

Heck, Ludwig Franz Friedrich Georg [1860–] Die Hauptgruppen des Thiersystems bei Aristoteles und seinen Nachfolgern, ein Beitrag zur Geschichte der zoologischen Systematik. *Inauguraldissertation* . . . 1884. Leipzig, 1885. iv, 70 p. 8°. Add. 1885.1

Heckel, Edouard. Traitement curatif de la morue rouge dont l'ingestion occasionne de véritables empoisonnements. *Arch. Méd. Navale*, 1887, **48**, 151–158. Add. 1887.1

— La morue rouge, reconnue toxique dans certains cas, l'est-elle toujours? *Rev. San.*, Bordeaux, 1887, **4**, 84. Add. 1887.2

— Sur le *Protopterus annectens*, Owen. *Naturaliste*, 1888, **10**, 233–234. Add. 1888.1

— Sur le traitement préventif du rouge de la morue. *C. R. Acad. Sci. Paris*, 1888, **106**, 220–222. Add. 1888.2

Heckel, Jakob. Recente Fische aus dem Dillner Erbstollen bei Schemnitz. *Jahrb. Geol. Reichsanst.*, Wien, 1851, **2**, 2. Hft., 185. Add. 1851.1

Hecker, W. Ueber die Pflege und Zucht von *Characidium (Jobertina) rachovii*. *Blätt. Aquar.-Terrar. Kunde*, 1914, 25. Jahrg., 385–387. fig. Add. 1914.1

Hecksher, John Gerard. [Sale] Catalogue of the library of the late John Gerard Hecksher. 3 pts. New York, 1909. 12°. Add. 1909.1

Contains 2442 items in ichthyology, angling, fisheries.

Hector, (Sir) James. Notes on the edible fishes of New Zealand. Colonial Museum and Geological Survey Department, Wellington, 1872. 36 p. Add. 1872.1

Issued with Hutton, F. W. *Fishes of New Zealand*. Gives native names of many fish.

— Critical notes on Mr. Davis's paper: [On the fossil fish remains of New Zealand]. *Rept. Geol. Surv. New Zealand Col. Mus.*, 1894, **22**, 115–120. Add. 1894.1

Hector, J.

— [*Xiphias gladius*, the northern sword-fish, compared with *Histiophorus herschelli*, or the antarctic sword-fish.] Trans. New Zealand Instit., 1897 (1898), 1898, **30**, 551-552. Add. 1898.1

Hederström, Jo. De aetate piscium. König. Schwed. Akad. Abh., 1759(1762), **21**, 215. Abstract in Comment. Lips., **10**, 207. Add. 1762.1

German edition, "Vom Alter der Fische." Berlin Samml., 1776, **8**, 349.

See also Hederström, H., 1759.1.

Hedley, Charles. General account of the atoll of Funafuti. Mem. Australian Mus., 1896, **3**, pt. 1, 1-71. Add. 1896.1

Fishing, p. 63-65.

— The ethnology of Funafuti. Mem. Australian Mus., 1897, **3**, pt. 4, 219-304. Add. 1897.1

Implements for fishing, p. 264-278, 14 figs. Palu (Ruvettus) hooks, p. 272-276.

Hedley, W. S. Animal electricity. Elect. Rev., 1899, **45**, 468-469. Add. 1899.1

Hegert, —. Märkische Fischereiurkunden [Mark Brandenburg] Märkische Forschungen, Berlin, 1882, **17**, 72—. Add. 1882.1

Heilprin, Angelo [1853-] A new species of catfish (*Ictalurus*). Proc. Acad. Nat. Sci. Philad., 1887, **9**. Add. 1887.1

— The geographical and geological distribution of animals. New York, 1897. 435 p. Add. 1897.1

Fishes, p. 287-305.

Hein, Walter. Bericht über den ersten Lehrgang der Fischereischule des Bayerischen Landes-Fischereivereins in Starnberg. München, 1910. 32 p. Add. 1910.1

— Fischerei der Ur- und Naturvölker. Deutsche Fischerei Zeitg., 1912, **35**, 262. Add. 1912.1

Heincke, Friedrich. Die nutzbaren Tiere der Nordischen Meere und die Bedingungen ihrer Existenz. Humboldt, Stuttgart, 1882, **1**, 40 p. text illust. 8°. Add. 1882.1

— Zur Kenntnis des Herings. Humboldt, 1884, **3**, 248-251, 302-303. Add. 1884.1

— Untersuchungen über die Stichlinge. [Variation, etc.] Overs. Kongl.

Vetens. Akad. Forhandl., 1889, 395-410. 6 figs. Add. 1889.1

— Report on plaice [Abstract] Nature, 1913, **91**, 481. Add. 1913.1

Hellant, Anders. De propagatione salmonis. Analect. Transalpin., Venice, 1762, **1**, 408. Add. 1762.1

See also Hellant, A. Pre-Linn. section, 1745.1.

Hellenius, Carl Nic. Anmerkung über die Würmer in der Leber der Aalquappen (*Gadus lota*) [*Lota vulgaris*]. König. Schwed. Akad. Neue Abhandl., 1785, 178. Add. 1785.1

See Hellenius, Carl Nic., 1785.1.

See also note under Kästner, A. G.

Heller, C. Das Süßwasser-Aquarium: ein Stück Natur im Hause. 2 ed. Leipzig, 1914. 186 p. 8°. Add. 1914.1

Hellevaara, E. Undersökningar rörande strömmingen i sydvästra Finland [Untersuchungen über den Ström-ling in südwest Finland] Finlands Fiskerier, Helsingfors, 1912, **1**, 20-62. Add. 1912.1

Hemme, (Pastor) Unterricht wie die so genannten Speisefische am besten aufzubehalten. Wittenberg Wochenbl., 1770, **3**, 333. Add. 1770.1

— Vom Salzhechte. Wittenberg Wochenbl. 1772, **5**, 9. Add. 1772.1

Hemmeter, John C. Methodik der gleichzeitigen Registrierung des Atem- und Herzrhythmus bei Selachiern. Zeitschr. Biol. Techn., 1911, **2**, 236. Add. 1911.1

— Vagushemmung und die anorganischen Salze des Herzens. I. Mitteilung. Untersuchungen am Herzen von Elasmobranchiern. Biochem. Zeitschr., 1914, **63**, 118-139. Add. 1914.1

CaO-Gehalt in gereiztem oder vagusgehemmtem Herzen unverändert, MgO etwas erhöht, NaCl verringert.

— Zur Biochemie des Vagusproblems. II. Mitteilung. Wechselseitige oder gekreuzte Zirkulation zwischen zwei Selachierherzen zur Entscheidung der Frage, ob Vagushemmung des einen Herzens Verlangsamung oder Aufhebung der Funktion des anderen durch Leitung des Blutes von "A" nach "B" verursachen kann. Biochem. Zeitschr., 1914, **63**, 140-150. 2 figs. Add. 1914.2

Aus gehemmten Herzen wird ins durchfließende Blut nichts ausgeschieden, wodurch

Tätigkeit eines 2. Herzen derselben Spezies verlangsamt oder zum Stillstand gebracht werden kann.

Henderson, J. B. Northeast coast fisheries (In his American diplomatic questions, 1901, 449-529).

Add. 1901.1

A well-balanced and clear account, with historical sketch.

Henicke, F. Die Fische. Illust. Naturg. Thiere 1882, 2, 343-351.

Add. 1882.1

Henkel, Fr., Baum, H., & Stansch, K. Die Pflanzen und Fische des Süßwasser-Aquariums, seine Anlage, Pflege und Unterhaltung. Darmstadt, 1907. 74 p. 92 figs. 8°. Add. 1907.1

Henking, H. Fünf-und-zwanzig Jahre im Dienste der deutsche Seefischerei. Ein Rückblick auf die Tätigkeit des deutschen Seefischerei-Vereins. Berlin, 1910. 216 p. map. 8°. Add. 1910.1

"Die Seefischerschulen des deutschen Seefischerei-Vereins." "Die Samariterkurse des deutschen Seefischerei-Vereins."

Henking, H., Wilhelm, O., & Duge, F. See **Duge, Henking, & Wilhelm.**

Henn, A. W. The range of size in vertebrates. Amer. Naturalist, 1912, 46, 157-162. Add. 1912.1

Henneguy, Louis Félix. Développement du système nerveux de la corde dorsale, et du mésoderme chez la truite. C. R. Mém. Soc. Biol. Paris, 1882, 34, 755-759. Add. 1882.1

— Division des noyaux et formation des cellules dans la parablaste des poissons osseux. C. R. Mém. Soc. Biol. Paris, 1882, 34, 142-144. Add. 1882.2

— Sur un infusoire flagellé ectoparasite des poissons. Journ. Microg., 1883, 7, 216-217 — C. R. Mém. Soc. Biol. Paris, 1884, 35, 137-139. Add. 1883.1

— De la ligne primitive des poissons osseux. C. R. Mém. Soc. Biol. Paris, 1884, 36, 702-706. Add. 1884.1

— Note sur un infusoire flagellé ectoparasite de la truite. Arch. Zool. Exper., 1884, 2, 403-411. Add. 1884.2

— Note sur le vésicule de Balbiani. C. R. Mém. Soc. Biol. Paris,

1887, 18. ser. 4, 68-69. — Bull. Soc. Philomath. Paris, 1887, 7. ser. 11, 116-119. Add. 1887.1

— La segmentation métamérique de la moelle allongée des poissons. Bull. Soc. Philomath. Paris, 1887-88 (1888), 7. ser. 12, 125-127. Add. 1888.1

— Histoire naturelle de la sardine. Rev. Marit. Colon., 1891, 108, 460-468. Add. 1891.1

— Nouvelle recherches sur la division cellulaire indirecte (de la truite), Journ. Anat. Physiol. Paris, 1891, 27, 397-423. pl. Add. 1891.2

Hennicke, Carl R. Eine eigentümliche Augenerkrankung bei Goldfischen. Zool. Garten, 1902, 43, 325. Add. 1902.1

Hennig, Edwin. Mesozoische Wirbeltierfunde in Adamaua. (In Mann, O., & Hennig, E., Mesozoische Ablagerungen in Adamaua, Kamerun. Beitr. Geol. Erforsch. Deutschen Schutzgebiete, Berlin, 1913. hft. 7, 10-29. pl.) Add. 1913.1

Lepidotus manni n. sp., Cretaceous of Kamerun.

— Wissenschaftliche Ergebnisse der Tendaguru-Expedition 1909-1912. Die Fischreste unter den Funden der Tendaguru-Expedition. Arch. Biontol., 1914, 3, Heft 4, 291-312. 4 figs. pl. Add. 1914.1

Records *Lepidotus minor* Ag. from the Wealden; *Carcharodon megalodon* Ag. from Miocene of Kitunda near Lindi; *Corax heterodon* Reuss, *Scapanorhynchus raphiodon* Ag., and *Lamna* sp. from Upper Cretaceous near Lindi, German East Africa.

Henrivaux, Jules. La destruction des mouches et des moustiques dangereux par des nouveaux moyens. La Nature, 1912, 40, pt. 2, 101-102. 5 figs. Add. 1912.1

Use of "millions" fish, Lebistes.

Henry, Herbert. On the hæmoprotozoa of British sea fish (a preliminary note) Journ. Pathol. Bacteriol. 1910, 14. Add. 1910.1

— *Spirochæta pollachii*: a new blood-inhabiting parasite from *Gadus pollachius*, the pollack: with a note on the occurrence of certain intracorporeal bodies in the blood of the Gadidæ. Journ. Pathol. Bacteriol., 1912-13, 17, 160-163. pl. Add. 1912.1

Henry, H.

— A list of blood parasites of sea fish taken at Plymouth. *Journ. Marine Biol. Assoc. Plymouth*, 1910-13 (1913), n. s. 9, 570-571. Add. 1913.1

Henry, W. Observations on the habits of the salmon family. *Trans. Lit. Hist. Soc. Quebec* [1838?] 3, 347-364. Add. 1838.1

Hensen, Victor. Ueber das Verhalten der Fische des Meeres beim Laichen und die Wichtigkeit dieses Vorganges für die Fischer. (In Meyer, H. A., Möbius, K., Karsten, G., & Hensen, V. *Gemeinfassliche Mittheilungen aus den Untersuchungen der Kommission zur wissenschaftlichen Untersuchung der deutschen Meere. Herausgegeben im Auftrage des Königlichen Ministeriums für Landwirthschaft, Domänen und Forsten.* Kiel, 1880. p. 41-56. 3 figs.) Add. 1880.1

— Ueber das Hören der Fische. *Münchener Med. Wochenschr.*, 1904, 51, 42. Add. 1904.1

— Ein Fortschritt in der Biologie der Fische [Clupea]. *Die Naturwissenschaften*, 1914, 2. Jahrg., 650-654. Add. 1914.1

"Wachstums- und Alterbestimmungen nach Jahresringen der Heringsschuppe."

Henshall, James A. Black bass fishing (in Mayer, A. M., *Sport with gun and rod, etc.*, p. 379-395. New York, 1883) Add. 1883.1

This is the full title for Anon. no. 284, iii.

— *Camping and cruising in Florida.* Cincinnati, 1884. 248 p. Add. 1884.1
List of 120 fishes observed, p. 235-241.

— The angling exhibit at the World's Fair. *Trans. Amer. Fisheries Soc.*, 1893, 129-131. Add. 1893.1

— A plea for the development and protection of Florida fish and fisheries. *Bull. U. S. Fish Comm.* 1897 (1898), 253-255. Add. 1898.1

— Mascalonge or maskinonge. *Forest & Stream*, 1904, 62, 253. Add. 1904.1

— Favourite fish and fishing. London, 1909. 204 p. illust. 8°. Add. 1909.1

Henshaw, H. W. Number of species of living vertebrates. *Science*, 1912, n. s. 36, 317-318. Add. 1912.1
12,000 fishes.

Herbert, M. J. "Canned gold-fish" [Salmon] The rich harvest of the north Pacific coast. *Scient. Amer. Suppl.*, 1914, 78, 276-277. 7 figs. Add. 1914.1

Herbst, J. F. W. Beschreibung der Flinder oder Hellebluttenlaus. *Schr. Ges. Naturf. Freunde Berlin*, 1782, 3, 94. fig. Add. 1782.1

Herdman, William Abbott [1858-] Some experiments on feeding fishes with nudibranchs. *Nature*, 1890, 42, 201-203. Add. 1890.1

— Distribution of marine organisms. [Presidential address to the Zool. Sect.] *Rept. Brit. Assoc. Advanc. Sci.*, 1895, 698-713. Add. 1895.1

— The marine fauna of the district, and the work of the Liverpool Marine Biological Committee. (In *Handbook to Liverpool and the neighbourhood . . . Brit. Assoc. Advanc. Sci.*, Liverpool, 1896. 191 p. 5 maps. 8°.) Add. 1896.1

— Report on the investigations carried on during 1913 in connection with the Lancashire Sea-fisheries Laboratory at the University of Liverpool and the seafish hatchery at Piel, near Barrow. *Proc. Trans. Liverpool Biol. Soc.*, 1914, 28, 91-466. pls. Add. 1914.1

Herdman, W. A., & Riddell, W. The plankton on the west coast of Scotland in relation to that of the Irish sea. Part ii. *Rept. Lancashire Sea-Fisheries Labor.* Liverpool, 1911 (1912), 155-174. Add. 1912.1

Herdman, W. A., & Scott, A. An intensive study of the marine plankton around the south end of the Isle of Man. Pt. iv. 19. *Rept. Lancashire Sea-Fish. Labor.* Liverpool, 1910 (1911), 191-232. *Ibid.*, 1911 (1912), pt. v, 127-154. *Ibid.*, 1913 (1914), pt. vii, 279-296. Add. 1911.1

Héricourt, J., & Richet, Ch. Action locale du sérum d'anguille. Sérothérapie contre les effets toxique du sérum d'anguille. *C. R. Mém. Soc. Biol. Paris*, 1897, 10. ser. 4 (49), 74-75. Add. 1897.1

— Sérothérapie in vitro dans l'intoxication par le sang d'anguille. *C. R. Mém. Soc. Biol. Paris*, 1897, 10. sér. 4 (49), 367-369. Add. 1897.2

Herman, Otto. *Umbra canina* (Mars.) Term. Fuz., 1882, **5**, 191-193. pl. Add. 1882.1

Text in Hungarian, résumé in German. p. 275.

Hermann, Fritz. *Barbus pyrrhop-terus*. Wochenschr. Aquar.-Terrar. Kunde, 1906, 3. Jahrg., 367-368. fig. Add. 1906.1

Hermann, Joh. (*præses*) Dissertatio: Affinitatum animalium tabula brevi commentario illustrata. Argentorati, 1777. 15 p. pl. 4°. Add. 1777.1

Geo. Ceph. Würtz, *respond.* Another edition, Argentorati, 1783.

— Affinitatum animalium olim academico specimine edita, nunc uberior commentario illustrata cum annotationibus ad historiam naturalem animalium augendam facientibus. Argentorati, 1783. 4°. Add. 1783.1

Agit docte de mammalibus, avibus, amphibis & piscibus.

Hermann, L. Neue vermeintliche Argumente für die Moleculartheorie des Muskel- und Nervenstroms. Archiv. Gesamt. Physiol., 1881, **26**, 483-493. Add. 1881.1

Based on study of electric fishes.

Herold, B. *Danio malabaricus*. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 585-586. fig. Add. 1914.1

Herrick, Charles Judson [1868-] [Review of *Pleuronectes* (the plaice) by Cole, F. J., & Johnstone, J., 1901.1] Science, 1902, n. s. **15**, 465-466. Add. 1902.1

— The sense of taste in fishes. Science, 1902, n. s. **16**, 345. Add. 1902.2

— The anatomy of the mackerel. Journ. Comp. Anat. Psych., 1904, **14**, 83-84. Add. 1904.1

Review of Allis, E. P., Jr., 1903.4

Herrick, Clarence L. [1858-] Contribution to the morphology of the bony fishes. Part 2. Studies on the brain of some American fresh-water fishes (continued). Journ. Comp. Neurol., 1892, **2**, 21-72. Add. 1892.1

— Notes upon the histology of the central nervous system of vertebrates (In Festschrift zum siebenzigsten Geburtstage R. Leuckarts, etc. Leipzig, 1892. xv, 413 p. illust. 4°.) Add. 1892.2

Herrick, E. C., & Dana, J. D. See Dana & Herrick.

Herrick, Francis Hobart. An abnormal black bass. Science, 1885, **6**, 243-244. Add. 1885.1

Herrmann, M. Christian Gotthold. Kurzer Unterricht für den practischen Landwirth, neue Fischteiche mit wenigen Kosten anzulegen, die Teichdämme wider Ueberschwemmung in Sicherheit zu setzen, die Fischnahrung nach gewissen Erfahrungen zu vermehren, und die Wässerung nach physikalischen Gründen zu veranstalten, nebst Vorschlägen die Stallfütterung ohne künstliche Futterkräuter sicher zu gründen. Freyburg, 1791. 8°. Add. 1791.1

Herter, Erwin. Ueber den Einfluss der Zubereitung auf die Verdaulichkeit von Rind- und Fisch-Fleisch, nach Versuchen von Hrn. Dr. Popoff. Arch. Anat. Physiol. (*Physiol. Abth.*), 1889, 561-563. Add. 1889.1

Hertwig, Günther, & Hertwig, Paula. Beeinflussung der männlichen Keimzellen durch chemische Stoffe. Arch. Mikr. Anat. 1913, **83**, 2. Abth., 267-306. 2 pls. & 6 figs. Add. 1913.1

Schädigung der Kernsubstanz, die zu allerlei embryonalen Missbildungen, sowie zu einer parthogenetischen nur durch den Eikern geleiteten Entwicklung führen kann. *Gobius jazo* studied.

— Kreuzungsversuche an Knochenfischen. Arch. Mikr. Anat., 1914, **84**, 2. Abth., 49-88. pl. Add. 1914.1

"Idioplasmatische Disharmonie der Kernsubstanzen."

Hertwig, [Wilhelm August] Oscar. Die Lehre von den Keimblättern. (In his Handbuch Entwicklungslehre der Wirbeltiere, **1**, pt. 1. Jena, 1906) Add. 1903.1

Issued 1903. Fishes, p. 713-733, 31 figs; 770-818. 82 figs.

— Missbildungen und Mehrfachbildungen, die durch Störung der ersten Entwicklungsprozesse hervorgerufen werden. (In his Handbuch Entwicklungslehre der Wirbeltiere, vol. i, pt. 1. Jena, 1906.) Add. 1903.2

Issued 1903; Fishes, p. 977-983, 10 figs; 986-993, 7 figs.

Herzenstein, Salomon Markovich. [1854?-1894] For biography and list of works, see Bull. Acad. Sci. St. Petersburg, 1896, **4**, 2-11.

Hess, C. Zur Physiologie und Pathologie des Pigmentepithels. [Anguilla] Ber. Opthal. Ges. Heidelberg, 1902, 352-357. Add. 1902.1

— Gesichtsinn (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. IV, p. 555-840. 45 figs. Jena, 1912). Add. 1912.1

i. Lichtsinn bei Fischen, p. 600-623, 7 figs.
ii. Das Sehorgan der Wirbeltiere, p. 719-762. 14 figs. iii. Akkommodation bei Fischen, p. 790-793. pl. & fig.

— Ueber Entwicklung von Lichtsinn und Farbensinn in der Tierreihe. Verh. Ges. Deutsch. Nat. Aerzte, 1913, 85. Vers., 1. Teil, 128-147. — Die Naturwissenschaften, 1913, 1. Jahrg., 1005-1006. Add. 1913.1

— Untersuchungen zur Physiologie des Gesichtsinnes der Fische. Zeitschr. Biol., 1914, 63, 245-274. 14 figs. Add. 1914.1

Verhalten sich wie ein total farbenblinder Mensch.

Hesse, Richard. Die Lichtempfindung des Amphioxus. Eine Antwort an Prof. W. Krause. Anat. Anz., 1898, 14, 556-557. Add. 1898.1

— Die Sehorgane des Amphioxus. Württemb. Jahreshefte, 1898, 54, lxxxiii-lxxxiv. Add. 1898.2

— Untersuchung über die Lichtempfindung bei niederen Tieren. IV. Das Sehorgan des Amphioxus. Zeit. Wiss. Zool., 1898, 63, 456-464. pl. Add. 1898.3

— Wie Fische steigen und sinken. Blätt. Aquar.-Terrar. Kunde, 1913, 24. Jahrg., 24-25. Add. 1913.1

Physiologisches über Schwimmblase.

Hessler, Ernst. Ueber den Bau und die Funktion der Fischblase. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 62-63; 86-87; 105-106. 3 figs. Add. 1914.1

Heublein, Carl Jacob. Beschreibung einer neuen Fischer-Geräthschaft, erfunden und mit Nutzen versucht. König. Schwed. Akad. Abhandl., 1774, 43. Add. 1774.1

See note under Kästner, A. G.

— Beskrifning på nytt fiskerskap, upfunnet och med nytta försökt. K. Svensk. Wet. Acad. Handl., 1774, 41. Add. 1774.2

Heuscher, Johannes. Zur Geschichte der Bodenseefischerei in der

Gegend von Rohrschach. Schweiz. Fischereizeitung, 1911, 19, no. 2, 25-30. Add. 1911.1

Hewitt, C. G. The insect food of fresh-water fishes; its economic importance in relation to fish culture and the conservation of fresh-water fish. Ann. Rept. Canad. Conserv. Comm., Ottawa, 1913, 4, 104-114. Add. 1913.1

Hewson, William [1739-1774]. The state of the controversy concerning the discovery of the lacteals and lymphatics in birds, fish, and the animals called amphibians. London, 1769. 4 p. 4°. Add. 1769.1

— An experimental inquiry into the properties of the blood, . . . and an appendix relating to the discovery of the lymphatic system in birds, fish and the animals called amphibians. London, 1771. xvi, 204 p. 12°. Add. 1771.1

Other eds., London, 1772, & 1780.

Heyking, — Eine Karpfenstadt [Rybnik] Fischereizeitung, 1911, 14, no. 33, 545-547. Add. 1911.1

— Wanderung durch deutsche Teichwirtschaften. Fischerei-Zeitg., 1912, 15, 501-504; 517-519. Add. 1912.1

— Zur Geschichte der künstlichen Fischzucht. Deutsch. Fischerei-Zeitg., 1913, 16, 485-486; 501. Add. 1913.1

— Das Fischereirecht der Neumühle bei Allenstein. Arch. Fischereigesch., 1914, Heft 2, 142-143. Add. 1914.1

Hickson, S. J. A naturalist in north Celebes. London, 1889. 392 p. illust. Add. 1889.1

Caudal breathing of *Periophthalmus*, p. 30-31; fishes in general, p. 112-115; 137-138; 221; fishing methods, p. 199-202. List of fishes, p. 262.

Higurashi, Chu. On the German carp introduced in Japan [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 3, 2-3. Add. 1914.1

Hilgendorf, Franz Martin [1839-] *Pterothrissus*, eine neue Clupeidengattung. Act. Soc. Leopoldina, 1877, pt. 13, 127-128. Add. 1877.1

Pterothrissus Hilgendorf; orthotype *P. gissu* Hilgendorf; replaces *Bathyrhissa* Gthr. (Nov. 1, 1877.)

— Ueber die Synonymie der Gattung *Pterothrissus*. Sitzber. Naturf. Freunde. Berlin, 1887, 187–188.
Add 1887.1

— Pisces. (In Ehrenberg, C. G. *Icones adhuc ineditæ, &c.* Berolini, 1899. 17 p. 32 pls. fol.)
Add. 1899.1

Hill, Charles. Developmental history of primary segments of the vertebrate head. Zool. Jahrb. (*Anat. Abth.*), 1900, **13**, 393–440. 3 pls. 4 text-figs.
Add. 1900.1
Teleosts, 404–424.

Hill, J. Fossils arranged according to their obvious characters. London, 1771, 420 p. 8°. Add. 1771.1

— An idea of an artificial arrangement of fossils, also of a natural method. London, 1774, 40 p. 8°. Add. 1774.1

Hill, Richard. Fishes of the Jamaica shores and rivers. Trans. Jamaica Soc. Arts, 1855. Add. 1855.1

Hill, Robert T. Geography and geology of the Block and Grand Prairies, Texas. 21. Ann. Rept. U. S. Geol. Survey, 1901, pt. 7. Add. 1901.1

Macrepistius arenatus Cope, in Comanche beds of the Cretaceous, p. 159. pl. 24.

Hillhouse, William. Indian notices, etc., also the ichthyology of the fresh waters of the interior [of British Guiana] Demerara, 1825. Add. 1825.1

Viviparity alleged and then oral gestation described for 18 siluroids, from page 108 on.

Hilton, William A. Record of two fish [*Porichthys notatus* and *Mola mola*], not before mentioned, from Laguna. Journ. Entom. Zool. Claremont, 1914, **6**, 233. Add. 1914.1

Hinckley, Isaac. The fish-eating cows of Provincetown, Mass. Bull. U. S. Fish Comm., 1881, **1**, 134. Add. 1881.1

Hinkelmann, —. Injuries to the fisheries of the Baltic by seals. Bull. U. S. Fish Comm., 1887, **7**, 81–83. Add. 1887.1

Hipler, J. Das Laichgeschäft des maulbrütenden Kampffisches (*Betta pugnax*) in der Nachzucht. Blätt. Aquar.-Terrar. Kunde, 1914, **25**. Jahrg., 473–477. fig. Add. 1914.1

Hirsch, Erwin. Untersuchungen über die biologische Wirkung einiger

Salze. Zool. Jahrb., Abt. Allg. Zool., 1914, **34**, 559–682. Add. 1914.1

Bestimmung der höchsten erträglichen Konzentration. Einfluss auf Pigmentierung.

Hirschfeld, —. Fünf Fälle von Fischvergiftung mit drei Todesfällen. Vierteljahrschr. Gerichtl. Med., Berlin, 1885, n. F. **43**, 283–293. Add. 1885.1

His, W. Zur Frage der Längsverwachsung von Wirbelthierembryonen. Verh. Anat. Ges., 1891, 70–83. 13 text-figs. Add. 1891.1
Bound in back of Anat. Anz., 1891, **6**.

— Lecithoblast und Angioblast der Wirbelthiere. Abhandl. Sächs. Ges. Wiss., Math.-Phys. Cl., 1900, **26**, 173–328. 102 text-figs. Add. 1900.1

Shark and salmon material largely used.

Hjort, Johan. Norges fiskerier. I. Norsk havfiske. Bergen, 1905. 373 p. charts, tabs. & ills. Add. 1905.1

Hjort, J., & Dahl, K. Fiskeforsøk i norske fjorde. Kristiania, 1899. 174 p. 40 figs. 3 maps. Add. 1899.1

Hjortberg, Gustaf Frederic. Beschreibung einer Guaperva [Pterophryne] die in dem Seegewächse Sargazo gefangen worden. König. Schwed. Akad. Abhandl., 1768 (1771), **30**, 353–355. fig. Add. 1771.1

Hobson, Edmund C. On the *Callorhynchus australis*. Tasmanian Journ. Nat. Sci., 1842, **1**, 14–20. 2 figs. Add. 1842.1

Hochstetter, —. Die Entwicklung des Blutgefäßsystems. (In Hertwig, O., Handbuch Entwicklungslehre der Wirbeltiere, vol. iii, p. 2, Jena, 1906) Add. 1906.1

Fische: p. 21–26, 7 figs.; p. 57–61, 6 figs.; p. 85–93, 7 figs.; p. 104; p. 111–112, fig.; p. 116–123, 18 figs.; p. 152–153, fig.

Hodge, F. W. (editor) Handbook of American Indians. Bureau American Ethnology. Washington, 1910. Add. 1910.1

Poisons, poisoning of fishes, pt. 2, p. 273.

Hodgson, W. Trout fishing. London, 1904. pl. 8°. Add. 1904.1

— Salmon fishing. London, 1906. 8 figs. 10 pls. 8°. Add. 1906.1

— How to fish; treatise on trout and trout-fishers. London, 1907. 390 p. illust. 8°. Add. 1907.1

Hoek, Paulus Peronius Cato [1851-1914] For a memorial notice, see in Verslag Konink. Akad. Wetensch., wissnat. Afd., Amsterdam, 1914, **22**, 1224-1228.

— Les Clupéides (le Hareng excepté) et leurs migrations. Conseil. Perman. Internat. Explor. de la Mer, Rapp. & Proc. Verb., 1914, **18**, 69.

Add. 1914.1

Höpfner, F. *Cichlosoma facetum*. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 329-332. 2 figs.

Add. 1914.1

Hoernes, R. Elemente der Paläontologie. (Paläozoologie) Leipzig, 1884. 594 p. 8°.

Add. 1884.1

Hofberg, Carl Frid. Fischgalle ein Mittel wider die Blindheit. Berlin Samml., 1767, **3**, 530. — Gaz. Lit. Eur., 1767, 431. — Frankf. Neue Anzeige, pt. 6, 241. — Alt. Gel. Merc., 1767, 377.

Add. 1767.1

Hofer, Bruno [1861-] Ueber Erkrankungen von Fischen durch Bakterien. Allg. Fischerei Zeitg., 1894, **19**, 202-205.

Add. 1894.1

— Ueber die Fischsterben in der Lindauer Ach und dessen Ursache. Allg. Fischerei Zeitg., 1895, **20**, 394.

Add. 1895.1

— Ueber Fischkrankheiten. Zeitschr. Fischerei, 1895, **20**. *Ibid.*, 1897, **22**.

Add. 1895.2

— Die Infektion der Fische mit Myxosporidien. Allg. Fischerei Zeitg., München, 1896, **21**, 38-39.

Add. 1896.1

— Eine bisher unbekannte Erkrankung der Kiemen bei der Forellen. Allg. Fischerei Zeitg., München, 1898, **23**, 256-257.

Add. 1898.1

— Blinde Fische. Allg. Fischerei Zeitg., München, 1898, **23**, 246.

Add. 1898.2

— Einheimische Parasiten in Amerikanischen Salmoniden. Allg. Fischerei Zeitg., München, 1898, **23**, 246-247.

Add. 1898.3

— Die Fleckenkrankheit der Eier. Allg. Fischerei Zeitg., München, 1898, **23**, 156-158.

Add. 1898.4

— Die Drehkrankheit der Regenbogenforelle. Wochenschr. Tierh. Vieh-

zucht, München, 1903, **47**, 79. — Berlin. Tierärztl. Wochenschr., 1903, no. 32, 500.

Add. 1903.1

Abstracts of Hofer, B., 1903.1

— Die Krankheiten der Fische. 5. Fortsetzung. Jahresb. Fortschr. Lehre Path. Microorganism., Braunschweig, 1901 (1903), **17**, 545-546.

Add. 1903.2

Review of Hofer, B., 1901.1

— Die Schlauffsucht des Karpfens. Allg. Fischerei Zeitg., München, 1904, **29**, 48-49. fig. — Bull. Instit. Pasteur, Paris, 1904, **2**, 215-216.

Add. 1904.1

Hofer, B., & Vogt, C. See **Vogt & Hofer**.

Hofer, J. Vom Wallenstädtersee und seinen Coregonen. Schweiz. Fischerei Zeitg., 1914, 22 Jahrg., 6-8.

Add. 1914.1

Hoffmann, Christian Karl. Contributions à l'histoire du développement des Plagiostomes. Arch. Néerland. Sci. Exact. Nat., Haarlem, 1881, **16**, 1-19; 97-115. 2 pls.

Add. 1881.1

— [Over den oorsprong en de beteekenis der zoogenaamde vrije kernen en van den voedingsdooier bij de beenvisschen.] Versl. Akad. Meded. Amsterdam, 1889, **5**, 3-4.

Add. 1889.1

— Over de ontwikkelingsgeschiedenis van de aorta en het hart bij het embryo van den haai (*Acanthias vulgaris*). Versl. Akad. Meded. Amsterdam, 1892, **9**, 349-350.

Add. 1892.1

Hoffmann, Ludwig. Das Visceralskelet von *Pristiophorus*. Zool. Jahrb. (Abth. Anat.), 1914, **38**, 157-210. 11 figs. pl.

Add. 1914.1

"Zwischenstellung zwischen Haien und Rochen."

Hoffmeyer, — Navnene paa de almindelige ferskvandsfisk (Fischnamen) Ferskvandsfiskeribladet, 1912, Heft 3, 15-. — *Ibid.*, Heft 4, 24-. — *Ibid.*, Heft 5, 30-.

Add. 1912.1

Hoffmeyer, C. W. Untersuchungen über normales und abnormales Fischblut. Bern, 1907. 31 p. 8°.

Add. 1907.1

See also Hoffmeyer, C. W., 1907.1.

Hofland, T. C. British angler's manual . . . with all the interesting plates. London, 1839. 16, 410 p. 8°.

Add. 1839.1

Hogg, John. On the existence of branchiæ in the young *Cæcilæ*: and on a modification and extension of the branchial classification of the Amphibia. *Ann. Mag. Nat. Hist.*, 1841, 7, 353-363. Add. 1841.1

Protomelus, orthotype *Lepidosiren annectens* Ow., p. 359.

Amphibichthys, orthotype *Lepidosiren paradoxa* Fitz., p. 362.

— On the artificial introduction of a breed of salmon into the river Swale. *Proc. Linn. Soc. London*, 1855, 2, 178-179. Add. 1855.1

Hohenleiter, Wolfgang, & Fritz, Martin. Das Fischereibuch Kaiser Maximilians I. Mit acht Gleichzeitigen Bildern und einer Lichtdrucktafel. Unter Mitwirkung von Ludwig Freih. v. Lazarin, herausgegeben von Dr. Michael Mayr. Innsbruck, 1901. xxviii, 52 p. 9 pls. fol. Add. 1901.1

Facsimile reproduction of one of the books planned and ordered written by Maximilian I. Executed by Wolfgang Hohenleiter, from material provided by the Imperial Master of Fisheries, Martin Fritz.

Holandre, —. Note sur un poisson du genre salmo qui n'a pas encore été signalé dans le département de la Moselle. *Mém. Soc. Hist. Nat. Dépt. Moselle*, Metz, 1843, 1. cahier, 116. Add. 1843.1

Holder, Charles Frederick [1851-1915] The nest builders of the sea. *Harper's Mag.*, 1883, 68, 98-107. Add. 1883.1

— Marvels of animal life. New York, 1885. 240 p. 31 pls. Add. 1885.1

Many notes on fishes.

— Stories of animal life. New York, 1899. Add. 1899.1

Some interesting accounts of fishes, p. 39; 115; 168; 194; 208; 228; 239.

Fishing with remora.

— Half hours with fishes, reptiles, and birds. New York, 1906. 255 p. illust. Add. 1906.1

Fishes, p. 7-79.

— Life in the open. Sport with rod, gun, horse and hound in Southern California. New York, 1906. 401 p. ills. 8°. Add. 1906.2

Much data about fish and fishing.

— The fishes of the Pacific coast. New York, 1912. 111 p. illust. Add. 1912.1

— Attempts to protect the sea fisheries of southern California. *California Fish & Game*, 1914, 1, no. 3, 9-19. Add. 1914.1

— Salt water game fishing. New York, 1914. 163 p. illust. Add. 1914.2

Holdsworth, Edwin William Hunt. Handbook to the fish-house in the gardens of the Zoological Society of London. London, 1860. 50 p. illust. 8°. Add. 1860.1

Holdsworth, R. On a specimen of the Umbrina (*Sciæna aquila* Cuv.) taken on the south coast of Devon. *Proc. Zool. Soc. London*, 1830-31 (1831), 112. Add. 1831.1

Holland, Eugène. Faune populaire de la France. 13 vols. Paris, 1877-1911. Add. 1877.1

Fishes, vol. III (1881), 82-185; vol. XI (1910), 150-248.

Hollande, A. C. Valeur nutritive de la chair de quelques poissons exotiques importés en France durant ces dernières années. *Bull. Sci. Pharmacol.*, 1913, 20, 405. Add. 1913.1

Holm, Iac. Wolrad. Dissertatio de pisce, a quo Jonas absorptus fuit. Hafniæ, 1766, 4°. Add. 1766.1

Holmes, E. Notes and sketches of the wild land explored. *Prelim. Rept. Nat. Hist. Geol. Maine*, 1861, 331-360. Add. 1861.1

Fishes, p. 353.

Holmquist, Otto. Der Musculus protractor hyoidei (geniohyoideus ant.) und der Senkungsmechanismus des Unterkiefers bei den Knochenfischen, zugleich ein Beitrag zur Kenntnis der Atembewegungen. *Fysiogr. Sällsk. Handl. Lund*, 1910, 21, 1. Abstract in *Centralb. Allgem. Exper. Biol.*, 1911, 2, 231. Add. 1910.1

Apparently same as Holmquist, Otto, 1910.1.

Holmwood, Francis. [Fishing with the Chazo (Remora) in Zanzibar] Official catalogue, Intern. Fisheries Exhib. London, 1883, 381-382. Add. 1883.1

Holt, Charles F. Breeding of black bass. *Forest & Stream*, 1886, 26, 91. Add. 1886.1

Holt, Ernest W. L. Some stages in the development of the brain of *Clupea*

Holt, E. W. L.

harengus. Proc. Roy. Soc. London, 1890, **47**, 199-202. Add. 1890.1

— [Note on *Argnoglossus laterna* (Walb).] Journ. Mar. Biol. Assoc., 1891-92 (1892), n. s. **2**, no. 3, 283. Add. 1892.1

— [Note on *Crystallogobius nilssonii* (Düb. and Kor.)] Journ. Mar. Biol. Assoc., 1891-92 (1892), n. s. **2**, no. 3, 283. Add. 1892.2

— [Note on *Gadus esmarkii* (Nilss.)] Journ. Mar. Biol. Assoc., 1891-92 (1892), n. s. **2**, no. 3, 282. Add. 1892.3

— [Note on *Hippoglossus vulgaris* Linn. (The halibut)] Journ. Mar. Biol. Assoc., 1891-92 (1892), n. s. **2**, no. 4, 399. Add. 1892.4

— [Note on *Rhombus maximus* Linn. (The turbot)] Journ. Mar. Biol. Assoc., 1891-92 (1892), n. s. **2**, no. 4, 399-404. Add. 1892.5

— [Note on *Scomber scomber* Linn. (The mackerel)] Journ. Mar. Biol. Assoc., 1891-92 (1892), n. s. **2**, no. 4, 396-397. Add. 1892.6

— [Note on *Sebastes norvegicus* (Ascau)] Journ. Mar. Biol. Assoc., 1891-92 (1892), n. s. **2**, no. 3, 283. Add. 1892.7

— [Note on *Chimæra monstrosa* Linn.] Journ. Mar. Biol. Assoc., 1893-95 (1893), n. s. **3**, no. 1, 120. Add. 1893.1

— [Note on *Gastrosteus pungitius* Linn.] Journ. Mar. Biol. Assoc., 1893-95 (1893), n. s. **3**, no. 1, 120. Add. 1893.2

— [Note on *Lumpenus lampetræformis* Walbaum.] Journ. Mar. Biol. Assoc., 1893-95 (1893), n. s. **3**, no. 1, 120. Add. 1893.3

— [Note on *Pleuronectes microcephalus* Donovan.] Journ. Mar. Biol. Assoc., 1893-95 (1893), n. s. **3**, no. 1, 121. Add. 1893.4

— [Note on *Raniceps raninus* Linn.] Journ. Mar. Biol. Assoc., 1893-95 (1893), n. s. **3**, no. 1, 119-120. Add. 1893.5

— [Note on *Scorpena dactyloptera*, De la Roche] Journ. Mar. Biol. Assoc., 1893-95 (1893), n. s. **3**, no. 1, 121. Add. 1893.6

— [Note on *Aphia pellucida* Nardo] Journ. Mar. Biol. Assoc., 1897-99 (1897), n. s. **5**, no. 1, 89. Add. 1897.1
Included in Holt, E. W. L., 1897.4.

— [Note on *Arnoglossus grohmanni* Bonaparte] Journ. Mar. Biol. Assoc., 1897-99 (1897), n. s. **5**, no. 1, 89. Add. 1897.2
Included in Holt, E. W. L., 1897.4.

— [Note on *Cantharus lineatus* Mont.] Journ. Mar. Biol. Assoc., 1897-99 (1897), n. s. **5**, no. 1, 89. Add. 1897.3
Included in Holt, E. W. L., 1897.4.

— [Note on *Gobius jeffreysii* Günther] Journ. Mar. Biol. Assoc., 1897-99 (1897), n. s. **5**, no. 1, 89. Add. 1897.4
Included in Holt, E. W. L., 1897.4.

— [Note on *Muraena helena* Linn.] Journ. Mar. Biol. Assoc., 1897-99 (1897), n. s. **5**, no. 1, 91. Add. 1897.5
Included in Holt, E. W. L., 1897.4.

— [Note on *Callionymus maculatus* Bonap.] Journ. Mar. Biol. Assoc., 1897-99 (1898), n. s. **5**, no. 3, 343. Add. 1898.1

— [Note on *Cepola rubescens* Linn.] Journ. Mar. Biol. Assoc., 1897-99 (1898), n. s. **5**, no. 2, 197. Add. 1898.2

— [Note on *Phrynorhombus unimaculatus* Risso] Journ. Mar. Biol. Assoc., 1897-99 (1898), n. s. **5**, no. 3, 343. Add. 1898.3

— [Note on *Trachinus draco* Linn.] Journ. Mar. Biol. Assoc., 1897-99 (1898), n. s. **5**, no. 2, 197. Add. 1898.4

— [Note on *Trigla obscura* Linn.] Journ. Mar. Biol. Assoc., 1897-99 (1898), n. s. **5**, no. 2, 197. Add. 1898.5

— [Note on *Trygon pastinaca* Linn. (stingray)] Journ. Mar. Biol. Assoc., 1897-99 (1898), n. s. **5**, no. 2, 198. Add. 1898.6

Holt, E. W. L. & Garstang, W. [Note on *Myliobatis aquila* Linn. The eagle-ray.] Journ. Mar. Biol. Assoc., 1897-99 (1898), n. s. **5**, no. 2, 198. Add. 1898.1

Holzappel, E. Die Geologie des Nordabfalles der Eifel mit besonderer Berücksichtigung der Gegend von Aachen. Abh. Preuss. Geol.

Landesanst., 1910, n. s. Heft 66. 218 p.
2 pls. & 15 figs. Add. 1910.1

Contains incidental reference to fishes.

Holzfuß, E. Die Atmung der Fische.
Wochenschr. Aquar.-Terrar. Kunde,
1914, 11. Jahrg., 37-41. 10 figs.
Add. 1914.1

— Die Fortpflanzung der Fische.
Wochenschr. Aquar.-Terrar. Kunde,
1914, 11. Jahrg., 571-574. 4 figs.
Add. 1914.2

Home, Everard (Sir) [1756-1832]
Observations on the structure of the
stomachs of different animals, with
view to elucidate the process of convert-
ing animal and vegetable substances into
chyle. Phil. Trans. Roy. Soc. London,
1807, 97, 139-178. 9 pls. Add. 1807.1
The codfish, p. 145, pl. & fig.; the blue shark,
p. 261, pl. & fig.

Hooker, (Sir) J. D. [28 water-
colour drawings and pencil sketches of
Antarctic fish made by Sir J. Hooker
during the voyage of the "Erebus" and
"Terror," 1839-43.] Add. 1839.1
On deposit in library British Museum
(Natural History).

— Himalayan journals; or, notes
of a naturalist in Bengal, the Sikkim
and Nepal Himalayas, etc. 2 vols.
London, 1854. Add. 1854.1

I. Birds beating water to scare fish, 80;
preserving fish, 151; fishing with baskets, 404.
II. poisoning fish, 7; diving and tickling fish,
13; use of nets and wiers, 327; fishing with otters,
355.

Hooper, J., & Collier, J. H. See
Collier & Hooper.

Hoppe-Seyler, F. Ueber Unter-
schiede im chemischen Bau und der
Verdauung höherer und niederer Tiere.
Arch. Gesammt. Physiol., 1877, 14,
395-400. Add. 1877.1

Some references to fishes.

Hore, Herbert Francis. An inquiry
into the legislation, control, and im-
provement of the salmon and sea fish-
eries of Ireland. Dublin, 1850. iv,
201 p. 8°. Add. 1850.1

Hornaday, W. T. Two years in the
jungle. The experiences of a hunter
and naturalist in India, Ceylon, the
Malay Peninsula and Borneo. New
York, 1888. 512 p. Add. 1888.1
Fishing with tuba, p. 384.

Hornell, J. Marine fish farming for
India. Fisheries Bull. Madras, 1911.
83 p. 7 pls. ills. Add. 1911.1

Horsburgh, A. Sketches in Borneo.
Anstruther, 1858. Add. 1858.1
Fishing methods, p. 40-41.

Horwood, A. R. The Upper Trias
of Leicestershire. Geol. Mag., 1913, 5.
dec. 10, 205-215. Add. 1913.1

**Hose, Charles, & McDougall, Wil-
liam.** The pagan tribes of Borneo. A
description of the physical, moral and
intellectual condition with some dis-
cussion of their ethnic relations. 2 vols.
London, 1912. Add. 1912.1

Fishing with hooks, nets, traps, wiers, with
tuba, "tickling," etc. vol. 1, p. 134-140, with
figures.

Houghton, William. Gleanings
from the natural history of the ancients.
London, [1880]. 252 p. 8°. Add. 1880.1
Fishes, p. 150-156; 218-238.

Houssay, Frédéric. Analyse et cri-
tique sur la signification métamérique
des organes latéraux chez les vertébrés.
Arch. Zool. Exp. Gén., 1891, 2. ser. 9,
iv-viii. Add. 1891.1

— The body shape of fishes.
Water pressure as the determining
cause. Scient. Amer. Suppl., 1911-12,
74, 12. fig. Add. 1911.1

— Sur la stabilité des poissons en
mouvement. C. R. Assoc. Franç.
Avanc. Sci., 40. sess. 1911, 1912,
(Proc.-Verb.), 34-35. Add. 1912.1

— The effect of water pressure
upon the form of fishes. A study of
evolution of form resulting from con-
ditions of life and habits. Scient. Amer.
Suppl., 1914, 78, 376-378. 11 figs.
Add. 1914.1

Houttyn, Martin. Aanmerkingen
over de voortteling der Hayen en der
Hayen Tasjes. Uitgezogte Verhand-
lingen, 1764, 9, 480-487. Add. 1764.1

Howard, Arthur Day. Experiments
in the propagation of freshwater mus-
sels of the *Quadrula* group. Rept.
U. S. Fish Comm. 1913 (1914), append.
4. 52 p. 6 pls. Add. 1914.1

— A new record in rearing fresh-
water pearl mussels. Trans. Amer. Fish-
eries Soc., 1914, 45-47. Add. 1914.2

— Some cases of narrowly re-
stricted parasitism among commercial
species of freshwater mussels. Trans.
Amer. Fisheries Soc., 1914, 41-44.
Add. 1914.3

Howell, D. Y. Injuries caused by gill nets to whitefish. Bull. U. S. Fish Comm. 1885, **5**, 324. Add. 1885.1

Howes, George Bond [1853-1905] The presence of a tympanum in the genus *Raja*. Journ. Anat. Physiol., London, 1883, **17**, 188-190. pl. Add. 1883.1

— *Lepidosiren paradoxa*. Nature, 1893-94, **49**, 576. Add. 1893.1

— Fish in relation to their surroundings (Lecture at Cornwall County Fisheries Exhibition, 1893) Truro, 1894. 26 p. Add. 1894.1

Howlett, Robert. School for recreation: or, a guide to the more ingenious exercises. London, 1784. 8°. Add. 1784.1

On fishing, pp. 158-182.

Hoxie, Walter. Occurrence of mullet in fresh water. Bull. U. S. Fish Comm. 1884, **4**, 80. Add. 1884.1

Hoyle, William E. Contributions to a bibliography of the "sea serpent." Proc. Roy. Phys. Soc. Edinb., 1885-88 (1888), **9**, 202-205. Add. 1888.1

Many references to fishes.

— On a deep-sea tow net for opening and shutting under water. Proc. Liverpool Biol. Soc., 1888-1889 (1889), **3**, 100-112. pl. 8°. Add. 1889.1

Huard, V. A. Les lamproies. Naturaliste Canadien, 1902, **29**, 166-169. Add. 1902.1

Huber, G. Carl. A contribution on the minute anatomy of the sympathetic ganglia of the different classes of vertebrates. Journ. Morph., 1899, **16**, 27-90. 3 pls. Add. 1899.1

Ambloplites rupestris, *Micropterus dolomieu*, *Perca flavescens* studied.

Hubrecht, Ambrosius Arnold Willem. For obituary notice see MacBride, E. W. 1915. 1.

— Kruipende Dieren en Visschen. Systematische Lijst. (In Midden-Sumatra. Reizen en onderzoekingen der Sumatra-Expeditie, uitgerust door het Aardrijkskundig Genootschap, 1877-1879, beschreven door de leden der Expeditie, onder toezicht van . . . P. J. Veth, **4**, pt. 1, no. 2, 20 p. pl. 1886. 8°.) Add. 1886.1

Hudson, Charles Bradford. Curious breadwinners of the deep. Cosmopolitan Mag., 1893, **15**, 756. fig. Add. 1893.1

Fishing with the remora.
How fishes get their food.

Hudson, Frank. Sea-fishing for amateurs, etc. London, 1888. 79 p. illust. Add. 1888.1

Hughes, Frank. The amount of fat in different fishes. Journ. Mar. Biol. Assoc., 1891-92 (1891), n. s. **2**, no. 2, 196. Add. 1891.1

Hulme, Nathaniel. Experiments and observations on the light which is spontaneously emitted, with some degree of permanency, from various bodies. Phil. Trans. Royal Soc., London, 1800, **90**, 161-187. Add. 1800.1

Light from putrescent fishes.

Humboldt, Alexander von [1769-1859] For biographies, see Klencke, P. F. H. 1851.1; 1852.1. Stevens, H. A. 1863.1; Wittwer, W. C. 1861.1.

— On the constitution and mode of action of volcanoes in different parts of the earth. Ann. Phil., 1823, **22** (n. s., **6**), 130. Add. 1823.1

Ejection or rain of *Pimelodes cyclopus*.

Hume, R. D. The salmon of the Pacific coast. San Francisco, 1893. 52 p. Add. 1893.1

Contains descriptions of habits of species.

— The first salmon cannery. Pacific Fisherman, 1904, **2**, 19-21. Add. 1904.1

Humphreys, H. Noel. Ocean gardens: the history of the marine aquarium, and the best methods now adapted for its establishment and preservation. 2 vols. [in 1] London, 1857. viii, 112 p. 12 pls. 8°. Add. 1857.1

Humphry, G. M. Observations in myology, including the myology of Cryptobranch, *Lepidosiren*, dog-fish, *Ceratodus*, and *Pseudopus pallasii*, with the nerves of Cryptobranch and *Lepidosiren* and the disposition of muscles in vertebrate animals. Cambridge & London, 1872. 192 p. 9 pls. 8°. Add. 1872.1

Hunt, Arthur Roope. Causes influencing the bathymetrical range of deep-sea fishes. Nature, 1888, **37**, 321. Add. 1888.1

Hunter, John [1728–1793] For biographies, see Adams, Joseph. Memoirs of the life and doctrines of the late John Hunter. London, 1816. 8°; Ottley, D. The life of J. Hunter (in vol. I of the Works of J. Hunter, edited by J. F. Palmer. 4 vols. London, 1835–37. 8° & 4°.)

— Observations anatomiques sur la torpille. Obs. Phys. Nat. Hist. & Arts, 1774, 4, 219–225. Add. 1774.1

— Observations on certain parts of the animal economy. London, 1786. 4°.

2nd ed., London, 1792. 4°. 3rd ed., (with notes by R. Owen), 1837. This latter forms vol. iv of works of J. Hunter edited by J. F. Palmer, London, 1835–37.

Huntington, George S. Comparative anatomy and embryology of vertebrates as aids in the teaching of human anatomy in the medical course. Amer. Journ. Med. Sci., 1898. 18 p. 13 figs. Add. 1898.1

Extensive use of fishes urged.

Hurdis, John L. Rough notes and memoranda relating to the natural history of the Bermudas. London, 1897. 408. p. Add. 1897.1

Fishes, p. 341–360.

Hutchins, D. E. The moon and poisonous fish. Nature, 1912, 90, 382; 417. Add. 1912.1

Hutchinson, Jonathan. On leprosy and fish-eating. A statement of facts and explanations. London, 1906. xix, 420 p. 6 illust. 10 maps. 8°. Add. 1906.1

Hutchinson, Thomas J. Two years in Peru, with exploration of antiquities. 2 vols. London, 1873. Add. 1873.1

Mortality of fishes, i. p. 219–225.

Hutton, F. W. Description of a new fish [*Labrichthys roseipunctata*] Trans. Proc. New Zealand Instit., 1878 (1879), 12, 455–456. Add. 1879.1

Hutton, J. Arthur. Salmon scales, as indicative of the life history of the fish. London, 1909. 32 p. 14 pls. 8°. Add. 1909.1

Read before Manchester Anglers Association.

Huxley, Thomas Henry [1825–1895] For biography see Osborn, H. F. 1896.1, 1896.2. See also Howes, G. B. Huxley. Roy. Coll. Sci. Mag., London, 1895. portr. 8°; Marsh, O. C. T. H. Huxley. A biography. Amer. Journ. Sci., 1895, 3, ser. 50. 7 p. 8°.

— Examination of the corpuscles of the blood of *Amphioxus lanceolatus*. Rept. Brit. Assoc. Adv. Sci., 1847, pt. 2, 95. Add. 1847.1

— On the development of the teeth, and on the nature and import of Nasmyth's "Persistent capsule." Quart. Journ. Micr. Sci., 1853. 16 p. pl. Add. 1853.1

Teeth of skate and mackerel studied.

— Vestiges of the natural history of creation. Tenth edition. London, 1853. Brit. & For. Med.-Chirurg. Rev., 1854, 425–439. Add. 1854.1

A review of an orthodox and very popular anonymous book.

— Tegumentary organs. (In Todd, Robert B. (Editor). The Cyclopædia of Anatomy and Physiology. London, 1855–56.) Add. 1855.1

Scales of fishes figured and described.

The fascicules, containing the above, published 1855–56.

— On Cephalaspis and Pteraspis. Philos. Mag., 1858, 4. ser. 15, 319–320. Add. 1858.1

— On the anatomy and affinities of the genus *Pterygotus*. (In Figures and descriptions illustrative of British organic remains. Monographs, vol. 1, pt. 1. Geological Survey Great Britain & Ireland, London, 1859, 1–36.) Add. 1859.1

— On the theory of the vertebrate skull. Proc. Roy. Soc. London, 1857–59 (1859), 9, 381–457. 10 figs. — Ann. Mag. Nat. Hist., 1859, 3, 414–439. Add. 1859.2

Carp, *Gasterosteus*, *Muraena*, *Elasmobranchs* studied.

— *Glyptolæmus kinnairdi*. Figures and descriptions illustrative of British organic remains. Mem. Geol. Surv. United Kingdom, 1861, 10. dec., 41–46. 2 pls. Add. 1861.1

— *Phaneropleuron andersoni*. Figures and descriptions illustrative of British organic remains. Mem. Geol. Surv. United Kingdom, 1861, 10. dec., 47–49. pl. Add. 1861.2

— On the classification of the animal kingdom. Journ. Linn. Soc. London, (Zool.), 1876, 12, 199–226. Add. 1876.1

— On the evidences as to the origin of existing vertebrate animals. Nature, 1876, 13, 388–. Add. 1876.2

Fishes, lecture I, p. 388–389.

Huxley, T. H.

— Inaugural address: Fisheries Exhibition, London, 1883. Internat. Fisheries Exhib. Lit., 1885, **4**, 3-22. Add. 1885.1

Huxley, T. H., & Salter, J. W. [On Pteraspis] Quart. Journ. Geol. Soc., 1856, **12**, 100. Add. 1856.1

Huxley, T. H., & Walpole, S. See **Walpole & Huxley.**

Hyatt, J. D. Echinorhyncus, an internal fish parasite. Journ. N. Y. Micr. Soc., 1896, **12**, 85. Add. 1896.1

Hyrtl, C. J. Ueber das Gefässsystem

der Fische. Med. Jahrb. Österr. Staates, 1838, **15**. Add. 1838.1

— Ueber die Structur des Eierstockes von *Ophidium barbatum* und des Peritoneal-Canales von *Mormyrus oxyrhynchus*. Sitzber. Akad. Wiss. Wien, mat.-nat. Kl., 1849, **2**, 357. Add. 1849.1

— Ueber *Mormyrus kaschive* und *Oxyrhynchus*. Sitzber. Akad. Wiss. Wien, mat.-nat. Kl., 1850, **5**, 280. Add. 1850.1

— Ansuchen um Beischaffung seltener Nilfische aus Chartum. Sitzber. Akad. Wiss. Wien, mat.-nat. Kl., 1851, **7**, 197. Add. 1851.1

I

Iggberg, Jonas. Prof pa fiskars, i synnerhet gäddors hastiga tillväxt. K. Svensk. Vetensk. Acad. Handl., 1758, 63. Add. 1758.1

Ihering, Hermann von. Die Lagoa dos Patos. Deutsch. Geogr. Blätt. Bremen, 1885, 164–205. Add. 1885.1

Arius commersonii a buccal incubator of eggs.

Ihō-Pale, —. La pêche en rivières, canaux et étangs. Paris, 1905. 360 p. ils.. 8°. Add. 1905.1

Pseudonym for Perreau, J. H. (q. v.).

Imhof, Othmar Emil. Die Verbreitung von *Silurus glanis*, L., in den stehenden Gewässern der europäischen Alpenkette. Biol. Centralb., 1892, 12, 716–718. Add. 1892.1

Inoko, K. The poisonous alkaloid in the *Anguilla japonica*, or Japanese eel [Text in Japanese] Tokio Med. Wochenschr., 1892, no. 754, 1. Add. 1892.1

— On the poison in fishes [Text in Japanese] Chiugai Iji Shinpo, Tokio, 1892, no. 300, 1–6. Add. 1892.2

Inwards, Richard. Weather lore; a collection of proverbs, sayings, and rules concerning the weather. New York, 1898. 233 p. Add. 1898.1
Fishes and weather, p. 170–172.

Isberg, C. (respond.) Dissertatio de piscinis. Upsaliæ, 1764. 4°. Add. 1764.1

J. Labtbom. *praeses*.

Isham, Charles. The fishery question; its origin, history, and present situation. Questions of the day, New York, 1887. 89 p. Add. 1887.1

With a map of the Anglo-American fishing ground, and a short bibliography.

Ishihara, M. Bemerkungen über die Atmung der Fische. [Elasmobranch and teleost] Centralb. Physiol., 1906, 20, 157–169. 2 text-figs. Add. 1906.1

Ishikawa, C., & Takahashi, N. Note on the eels of Japanese, Corean, Formosan and adjacent waters. Journ. Coll. Agric., Tokyo, 1914, 4, 415–433. 3 pls. Add. 1914.1

Issel, Raffaele. Saggio sulla fauna termale italiana. Boll. Mus. Zool. Anat. Comp. Genova, 1900, 4, no. 100. 4 p. Add. 1900.1

Istvénessi, J. Ueber die natürliche Ernährung der Fischbrut. Deutsch. Fischerei Zeitg., 1894, 382. Add. 1894.1

Ivanzov, Nikolaj A. The difficulty presented by the electric organ of fishes for the theory of Darwin [Text in Russian] Bull. Soc. Nat. Moscou, 1895, 8, (Prot.), 17–18. Add. 1895.1

Ives, J. E. Mimicry of the environment in *Pterophryne histrio*. Proc. Acad. Nat. Sci. Philad., 1889, 344–345. Add. 1899.1

Ivolas, J. La pêche en Loire. Bull. Soc. Languedoc Géogr., Montpellier, 1893, 16, 237–291; 354–415. Add. 1893.1

J

J., C. Die Häringsfischerei auf Island. Das Ausland, 1885, **58**, 493-495. Add. 1885.1

J., J. La mémoire chez les poissons. Rev. Sci., 1897, **7**, 348. Add. 1897.1

J., L. Le botulisme produit par le poisson gâté. Méd. Mod., Paris, 1899, **10**, 155. Add. 1899.1

Jääskeläinen, V. Anteckningar om Kemiåls fiskfauna [Ueber die Fischfauna des Kemi-Flusses, Finland] Finlands Fiskerier, Helsingfors, 1913, **2**, 133-204. 10 figs. Add. 1913.1

Jaboulay, — Poissons atteints des goitres malins héréditaires et contagieux. Journ. Med. Chir. Prat., 1908, **79**, 239. Add. 1908.1

Jackson, C. T. Fish and shells from lake Superior [Note] Proc. Boston Soc. Nat. Hist., 1844, **1**, 198. Add. 1844.1

Jackson, Humphrey. Essay on English isingglass, its nature and properties. The best methods of converting it into fining glaze and starch. An analysis of isingglass and a rationale of its clarifying liquors. London, 1765. 8°. Abstract in Jen. Gel. Zeit., 1766, 55 st. Add. 1766.1

Product of swim bladder of sturgeon.

Jackson, J. W. Strophodus teeth in the Corallian beds of Malton, Yorkshire. Naturalist, Hull, 1911, 151. Add. 1911.1

Jacobi, A. Der grosse Dorschfang und die Stockfischbereitung auf Lofoten. Himmel und Erde, 1913, 25. Jahrg., 547-553. 5 figs. Add. 1913.1

Jacobi, Stephen Ludwig. On the breeding of fish and the natural history of their generation. On the breeding of trout. Philos. Mag., 1809, **34**, 324-333. Add. 1809.1

See also Jacobi, S. L., 1765.1

Jacobs, Thomas Jefferson. Scenes, incidents and adventures in the Pacific ocean . . . during the cruise of the

clipper Margaret Oakley under Capt. Benjamin Morrell. New York, 1884. Add. 1884.1

Habits of archer fish, p. 189; fishing with pearl hook at Bougainville island, p. 227; fishing with nets in China sea, p. 343.

Jacobsen, J. Adrian. Reise in die Inselwelt des Banda-Meeress. Berlin, 1896. 271 p. Add. 1896.1

Fishing with hooks, p. 29, 78, 202; with bow and arrow, p. 30, 89, 147, 184; with harpoon and spear, p. 30, 76, 134, 184; with nets, p. 89, 108, 147, 184; with poisonous plants, p. 78, 108; with the kite, p. 77-78, fig.

Jacobson, Herman (translator) The Iceland shark-fisheries. Bull. U. S. Fish Comm. 1885, **5**, 301-304. Add. 1885.1

Translation of an anonymous article, "Havkalfangsten fra Island", from Fiskeritidende, Copenhagen, 1884, no. 46.

— The artificial propagation of sturgeon in Schleswig-Holstein, Germany. Bull. U. S. Fish Comm. 1889 (1891), **9**, 81-90. Add. 1891.1

Translations, from the German, of various short articles.

Jaeger, G. Das Leben im Wasser und das Aquarium. 4th ed. Stuttgart, 1913. 367 p. 151 figs. 9 pls. 8°. Add. 1913.1

Jaekel, Otto [1863-] [An Herrn W. Dames ueber Coccoosteus] Zeitschr. Deutsch. Geol. Ges., 1890 (1891), **42**, 773-774. Add. 1890.1

— *Oracanthus bochumensis* n. sp., ein Trachyacanthide des deutschen Kohlengebirges. Zeitschr. Deutsch. Geol. Ges., 1890, 753-755. pl. Add. 1890.2

— Ueber die systematische Stellung und über fossile Reste der Gattung *Pristiophorus*. Zeitschr. Deutsch. Geol. Ges., 1890, **42**, 86-120. 4 pls. Add. 1890.3

— Ueber Tertiäre Trygoniden. Zeitschr. Deutsch. Geol. Ges., 1890, **42**, 365-366. Add. 1890.4

Trygon thalassia fossilis, n. subsp., Miocene of Baltringen, Württemberg.

— *Onychodus sigmoides*, Newb., aus dem Devon Nordamerikas. Zeitschr. Deutsch. Geol. Ges., 1892, **44**, 509.
Add. 1892.1

— Unter-Tertiäre [Oligocene] Selachier aus Südrussland [Text in Russian and German] Mém. Comité Géol., 1895, **9**, no. 4, 1–35. 2 pls.
Add. 1895.1

Reviewed by C. R. Eastman in Amer. Geol., 1896, **17**, 245–247.

— [Reste eines neuen Placodontiden aus dem unteren Keuper von Vesprem am Plattensee in Ungarn.] Zeitschr. Deutsch. Geol. Ges., 1901, **53**, 56–57.
Add. 1901.1

James, Bushrod W. International protection for denizens of the sea and waterways. Bull. U. S. Fish Comm. 1897 (1898), **17**, 257–263. — Rept. Fish Comm. State of Pennsylvania, 1898, 170–178.
Add. 1898.1

James, M. R. (compiler) Catalogue of manuscripts and early printed books from the libraries of William Morris, Richard Bennett, Bertram, fourth Earl of Ashburnham, and other sources, now forming a portion of the library of J. Pierpont Morgan. Manuscripts. London, 1906. xix, 210 p. 20 col. pls.
1906.1

No. 107. Bestiary of late xii century (circa 1170) of 120 folios, given by Philip, Canon of Lincoln, in 1187 to the Augustinian priory of Radford, now Worksop. The section entitled "De naturis piscium," folio 68b, is illustrated by a figure of two men in a ship; a winged fish, the "serra" is represented in the air above.

No. 108. Of the government of health. A treatise in French in four parts on health and diet, dating from about the middle of the xv century. Among the finely drawn illustrations is one (fol. 132) showing fish in a stream.

Jameson, R. Cows, horses and sheep fed on fish in Persia [Quotation from Fraser's Travels] Edinburgh New Phil. Journ., 1826, **1**, 197.
Add. 1826.1

Janière, S. Recherches sur les poissons vénéneux de la Guadeloupe. Nantes, 1831. 4°. Add. 1831.1

Jardine, Alfred. Pike and perch, with notes on record pike and a chapter on the black bass, Murray cod and other sporting members of the perch family. London, 1898. 143 p. illust.
Add. 1898.1

Jaubert, — La Napoule et ses pêcheries. Nice, 1905. pl.
Add. 1905.1

Jenks, Albert Ernest. The Bontoc Igorot. Philippine Ethnological Survey Publications, Manila, 1905, **1**.
Add. 1905.1

Fishing with the hands, with traps, and by diving, p. 85–87.

Jensen, Adolf Severin [1866–] Nye iagttagelser over havaalens fortplantning referede [New observations on the transplantation of the marine eel] Dansk Fiskeriforen. Medlemsbl., 1892, 1. aarg., 37–41; 59–60.
Add. 1892.1

— The selachians of Greenland. Mindeskraft for Japetus Steenstrup, København, 1914, no. 30. 40 p. pl.
Add. 1914.1

Jensen, F. Ferskvandsfiskeriet i landbruget [Inland fishery in agriculture] Varde, 1905. 72 p. illust. 8°. Add. 1905.1

Jesse, E. Maxims and hints for an angler, being the appendix to his Gleanings in Natural History. Philadelphia, 1883. 12°. Add. 1883.1

For complete work, see Jesse, E., 1832.1.

Jiménez de Cisneros, Daniel. Noticia acerca de algunos fósiles existentes en los institutos del norte de España. Bol. Soc. Españ. Hist. Nat., 1911, **11**, 544–554.
Add. 1911.1

Jørgensen, Max. Zellenstudien. I. Morphologische Beiträge zum Problem des Eiwachstums. Arch. Zellenforsch., 1913, **10**, 1–126. 16 figs. 12 pls.
Add. 1913.1

Studies based in part upon fish material.

Johansen, A. C. Contributions to the biology of the plaice, with special regard to the Danish plaice fishery. VI. On the immigration of plaice to the coastal grounds and fiords on the west coast of Jutland. Meddel. Komm. Havundersøgelser Fiskeri, Kjøbenhavn, 1913, **4**, no. 4, 1–26. Add. 1913.1

— Vierter Bericht über die Pleuronectiden in der Ostsee. Conseil Perm. Internat. Explor. Mer, Rapp. & Proc.-Verb., 1913, **16**, 1–35. 23 tables.
Add. 1913.2

Johansen, A. C., & Krogh, A. The influence of temperature and certain other factors upon the rate of development of the eggs of fishes. Publ. Circ., Copenhagen, 1914, **68**, 44 p. 14 figs.
Add. 1914.1

John, — (*Missionary at Tranquebar*) Beschreibung und Abbildung des *Uranoscopus lebeckii*. Neue Schrift. Ges. Naturf. Freunde Berlin, 1801, **3**, 283-287. fig. Add. 1801.1

Johnson, J. M. Résumé of work done during the past year in the raising of western charr in eastern waters. Trans. Amer. Fisheries Soc., 1904, 193-222. Add. 1904.1

Johnson, R. D. O. The climbing catfish [*Arges marmoratus*]. A fish that prefers climbing to swimming. Scient. Amer., Suppl., 1913, **75**, 229. 4 figs. Add. 1913.1

Johnson, R. S. The magnitude and scope of the work of the U. S. Bureau of Fisheries, 1910. Trans. Amer. Fisheries Soc. 1910 (1911), 169-172. Add. 1911.1

Johnsson, Pehr. Fiskodling i äldre tider. Några anteckningar. [Fish hatching in earlier times. Notes.] Skrift Södra Sveriges Fiskerifören., 1913, no. 11, 67-71. Add. 1913.1

Johnston, Robert M. Description of two new species of fishes (*Trachichthys macleayi*, and *Mendosoma allporti*) caught in the estuary of the Derwent. Proc. Roy. Soc. Tasmania 1880 (1881), 54-57. Add. 1881.1

— Description of a species of sea bream (*Girella tricuspidata*) from Southport, Tasmania. Proc. Roy. Soc. Tasmania 1881 (1882), 49. Add. 1882.1

— Description of a new species of fish [*Lophotes guntheri*] caught near Emu bay, Tasmania. Proc. Soc. Tasmania 1882 (1883), 176-178. Add. 1883.1

— Note on *Clinus despicillatus*, Richardson, and *Bovichthys variegatus*, ibid. Proc. Roy. Soc. Tasmania 1882 (1883), 170. Add. 1883.2

Describes viviparity in *Clinus*.

— [On two fishes new to the fauna of Tasmania] Proc. Roy. Soc. Tasmania 1883 (1884), lviii-lix. Add. 1884.1

Chilodactylus carponemus and *Sphyræna nova hollandiæ*.

This is the correct title, replacing completely Johnston, 1884.2 which is erroneous.

— Notes with respect to the fresh water fishes, and the land and fresh water molluscs of King's Island. Proc. Roy. Soc. Tasmania, 1887, 74-76. Add. 1887.1

— A [fossil] ganoid fish [*Acrolepis hamiltoni*] Proc. Roy. Soc. Tasmania, 1890 (1891), vii. Add. 1890.1

Johnston, R. M. & Morton, A. Notes on the discovery of a ganoid fish [*Acrolepis hamiltoni* n. sp.] in the Knocklofty Sandstones, Hobart. Proc. Roy. Soc. Tasmania, 1889, 102-104, 2 pls. Add. 1889.1

— Description of a second ganoid fish [*Acrolepis tasmanicus*] from the lower Mesozoic sandstones near Tinderbox bay. Proc. Roy. Soc. Tasmania 1890 (1891), 152-154. Add. 1890.1

Johnstone, James. Report on measurements of plaice made during the year 1911. Trans. Liverpool Biol. Soc., 1912, **26**, 85-102. Add. 1912.1

— Internal parasites and diseased conditions of fishes. 22. Rept. Lancashire Sea-Fisheries Labor., Liverpool, 1913 (1914), 37-54. 4 pls. Add. 1914.1

Trematodes and protozoa.

— Report on the plaice measurements made in the eastern waters of the Irish sea during the years 1909-1913. 22. Rept. Lancashire Sea-Fisheries Labor., Liverpool, 1913 (1914), 78-149. — Trans. Liverpool Biol. Soc., 1914, **28**, 168-239. 5 figs. Add. 1914.2

Johnstone, James, & Monaghan, T. Report on the experiments with marked fishes made during the year 1913. 22. Rept. Lancashire Sea-Fisheries Labor., 1913 (1914), 150-159. 6 figs. — Trans. Liverpool Biol. Soc., 1914, **28**, 240-279. 6 figs. Add. 1914.1

Jokisch, Karl. Handbuch der Fischerey. Ronneburg & Leipzig, 1802. 294 p. 8°. Add. 1802.1

Joliet, L. Sur les poissons électriques et pseudo-électriques. Arch. Zool. Expér. Paris, 1876, **5**, iv-vii. Add. 1876.1

Review of Sihleanu, S., 1876.1.

Jolyet, Félix. Conclusions de recherches faites sur la respiration des poissons. Mém. Soc. Sci. Bordeaux, 1880, 2. sér. **3**, xxiv. Add. 1880.1

Complete citation for Jolyet, F. 1880.1.

— Recherches sur la torpille électrique. Ann. Sci. Nat. Bordeaux, 1883, 2. ann., 17. Add. 1883.1

— La torpille et sa décharge électrique. Journ. Hist. Nat. Bordeaux, 1883, 2. ann., 38. Add. 1883.2

Jolyet, Félix, & Regnard, Paul. Recherches physiologiques sur la respiration des animaux aquatiques, part 1. Arch. Physiol., 1877, 2. ser. 4, (9. année), 44-62. figs. Add. 1877.1

Jolyet & Regnard, 1877.1, is part 2 of this research.

Jones, F. Wood. Corals and atolls. London, 1912. Add. 1912.1

Extensive notes on fishes of Cocos-Keeling archipelago.

Jones, H. L., & Shore, Th. W. See **Shore, Th. W., & Jones, H. L.**

Jones, S. Griffith. Notes on specimens of the marbled angler fish, pipe fish, *Janthina* and *Carinaria*, kept alive at sea. Proc. Liverpool Lit. Phil. Soc., 1884, 38, liii-lix. Add. 1884.1

Jordan, August. [*Triodus sessilis*, ein neuer Fisch der Kohlen-Formation von Lebach.] Neues Jahrb. Mineral., 1849. 843. fig. Add. 1849.1

Synonym of *Pleuracanthus decheni*.

Jordan, David Starr [1856-] Catalogue of fishes of Ohio. Appendix to Report Fish Commission Ohio, 1876 (1877). Add. 1877.1

— Description of a new scorpænoid fish (*Sebastichthys proriger*) from Monterey Bay, California. Proc. U. S. Nat. Mus. 1879 (1880), 2, 327-329. Add. 1880.1

— Notes on the nomenclature of certain North American fishes. Proc. U. S. Nat. Mus., 1883, 110-111. Add. 1883.1

— The geographical distribution of fresh-water food-fishes in the several hydrographic basins of the United States. (In the fisheries and fishing industries of the United States, edited by George Brown Goode, 1887, 3. sect., p. 133-154.) Add. 1887.1

— The sea-fishing grounds of the Pacific coast from the straits of Fuca to Lower California (In The fisheries and fishery industries of the United States, edited by George Brown Goode, 1887, sect. 3, p. 79-80) Add. 1887.2

— The distribution of fresh-water fishes. 8. Ann. Rept. Michigan Fish

Comm., 1888, 108-120. — Trans. Amer. Fisheries Soc., 1888, 4-25. Add. 1888.1

— [Description of six species of North American fresh-water fishes] (In Agassiz, Louis, & Baird, S. F., 1889.1) Add. 1889.1

— Note on the occurrence of the opah [*Lampris guttatus*] on the Grand banks. Bull. U. S. Fish Comm. 1887 (1889), 7, 202. Add. 1889.2

— The Sunapee trout, *Salvelinus alpinus aureolus*. Forest & Stream, 1891, 36, 6-7. Add. 1891.1

— Description of another species of trout (*Salmo gairdneri*) 12. Bienn. Rept. State Board Fish Comm. California, 1891-92 (1892), 60-61. pl. Add. 1892.1

— Description of a new species of trout (*Salmo kamloops*) from the lakes of British Columbia. Rept. State Board Fish Comm. California, 1891-92 (1892), 60-61. pl. Add. 1892.2

— Description of the golden trout of Kern river. 12. Bienn. Rept. State Board Fish Comm. California 1891-92 (1892), 62-65. pl. Add. 1892.3

— Salmon and trout of the Pacific coast. 12. Bienn. Rept. State Board Fish Comm. California 1891-92 (1892), 44-58. Add. 1892.4

— Note on *Emmydrichtys vulcanus*. Proc. California Acad. Sci., 1897, 2. ser. 6, 562. Add. 1897.1

— Pacific species of salmon and trout. 18. Bienn. Rept. State Board Fish Comm. California 1903-04 (1904), 75-97. Add. 1904.1

Advance notes from "A Guide to the Study of Fishes," 1905.1.

— Salmon hybrids. Science, 1906, n. s. 23, 434. Add. 1906.1

— Work of the international fisheries commission of Great Britain and the United States. Proc. 4. Intern. Fish. Cong., Washington, 1908. Bull. U. S. Bur. Fisheries 1908 (1910), 28, part 1, 181-186. Add. 1910.1

— Notes on ichthyology [Review of recent literature] Amer. Naturalist, 1912, 46, 746-754. Add. 1912.1

— The genera of fishes, 1758-1920, with the accepted type of each. A contribution to the stability of scientific

Jordan, D. S.

nomenclature. Leland Stanford Jr. Univ. Pubs., Univ. Series. 4 pts. 1917-20. 576 p. & indices. Add. 1917.1

i. From Linnæus to Cuvier, 1758-1833, seventy-five years. (With the assistance of B. W. Evermann. See Jordan & Evermann, Add. 1917.1), p. 1-161.

ii. From Agassiz to Bleeker, 1835-58. p. iv, 162-284 & xiii (index).

iii. From Günther to Gill, 1859-80. p. 285-410 & xv (index).

iv. From 1881-1920, thirty-nine years. p. 411-576 & xviii (index).

Jordan, D. S., & Bollman, C. H. Scientific results of explorations by the U. S. Fish Commission steamer Albatross. IV. Descriptions of new species of fishes collected at the Galapagos Islands and along the coast of the United States of Colombia, 1887-1888. Proc. U. S. Nat. Mus., 1890, **12**, 149-183. Add. 1890.1

Jordan, David Starr, & Evermann, Barton Warren. The genera of fishes from Linnæus to Cuvier, 1758-1833, seventy-five years with the accepted type of each. A contribution to the stability of scientific nomenclature. Stanford University, 1917. 161 p. Add. 1917.1

Review by Cockerell, T. D. A., Science, 1918, n. s. **47**, 195-196.

For subsequent parts, see Jordan, David Starr, above.

Jordan, D. S., & Fesler, Bert. Description of a new species of Orthopristis from the Galapagos islands. Proc. Acad. Nat. Sci. Philad., 1889, 36-37. Add. 1889.1

Jordan, David Starr, & Fordice, M. W. A review of the North American species of Petromyzontidæ. Ann. N. Y. Acad. Sci., 1885, **3**, 279-296. Add. 1885.1

Jordan, David Starr, & Gilbert, C. H. The salmon fishing and canning interests of the Pacific coast (In the fisheries and fishery industries of the United States, edited by George Brown Goode, sect. 5, vol. i, p. 729-753. pl. 1887) Add. 1887.1

Joseph, Heinrich. Ueber die Achsenskelet des Amphioxus. Zeitschr. Wiss. Zool., 1895, **59**, 511-536. 2 pls. Add. 1895.1

— Beiträge zur Flimmerzellen und Centrosomefrage. Arb. Zool. Instit. Wien, 1902 (1903), **14**, 1-80. 3 pls. 3 figs. Add. 1903.1

In part worked out on fish material.

— Ueber die Zentralkörper der Nierenzelle. Verhand. Anat. Ges., 1905, 19. Vers., pp. 178-187, 16 figs. Add. 1905.1

— Ueber Epithelmuskulatur bei Amphioxus. Verh. Ges. Deutsch. Nat. Aerzte, 1914, 85. Vers., pt. 2, Hälfte 1, 706-709. Add. 1914.1

“Gewebe, die bei den echten Vertebraten einen völlig mesenchymatischen Charakter aufweisen können bei Amphioxus noch in rein epitheliale Zustand persistieren Gefäßsystem.”

Josselyn, John, & Trumbull, J. Hammond. See Trumbull & Josselyn.

Jouan, Henri. Les poissons et les oiseaux de haute mer. Bull. Soc. Linn. Normandie, Caen & Paris, 1880-81 (1881), 3. sér. **5**, 332. Add. 1881.1

Correct citation for Jouan, H. 1881.1.

— Epoques et mode d'apparition des différentes espèces de poissons sur les côtes des environs de Cherbourg. Bull. Soc. Linn. Normandie, Caen, 1890, **4**, 118-130. Add. 1890.1

Joubin, L. Sur les animaux marins; influence du milieu sur leur biologie, leur répartition, leur variations. Monaco, 1905. 185 p. 177 figs. 8°. Add. 1905.1

— Notes sur la biologie de la sardine. Bull. Trim. Enseign. Pêches Maritimes, 1913, **18**, 216-222. Add. 1913.1

Jouenne, Lucien, & Perreau, J. H. La pêche au bord de la mer. Paris, 1912. 311 p. 8°. Add. 1912.1

Jourdain, Amable. Recherches critiques sur l'âge et l'origine des traductions latines d'Aristote et sur des commentaires grecques ou arabes employés par les docteurs scholastiques; nouvelle édition revue et augmentée par Charles Jourdain. Paris, 1843. 472 p. 8°. Add. 1843.1

Jousset, P., & Lefas, — Action des venins par la voie stomacale. C. R. Mém. Soc. Biol. Paris, 1904, **56**, 2. tome, 472. Add. 1904.1

Eel serum used.

Jousset de Bellesme, George Louis Marie Félicien [1839-] Essai d'acclimatation de nos poissons d'eau douce au Chili. Rev. Sci., 1888, **41**, 104-109. Add. 1888.1

— Acclimatation et multiplication du saumon de Californie (*Salmo quin-*

nat) en France et spécialement dans le bassin de la Seine pendant la période 1885-90. Bull. Soc. Acclim. France, 1891, **38**, 1. sem., 594-607.

Add. 1891.1

— Les proies vivantes en pisciculture. Rev. Sci., 1892, **49**, 527-530.

Add. 1892.1

— Nouvelle méthode de culture des étangs. C. R. Acad. Sci., Paris, 1894, **119**, 924-926.

Add. 1894.1

— Le sang et la rate dans l'alimentation des alevins. Bull. Soc. Acclim. France, 1895, **42**, 61-68.

Add. 1895.1

Juday, C., & Birge, E. A. See **Birge & Juday.**

Jürgens, W. Der Flösselaal, *Calamichthys calabaricus* Smith. Blätt. Aquar.-Terrar. Kunde, 1906, **17**, 415.

Add. 1906.1

— Ueber die Larven von *Hyperopisus bebe* Lac. Blätt. Aquar.-Terrar. Kunde, 1910, **21**, 163.

Add. 1910.1

Jungersen, Hector Frederik Estrup. On the appendices genitales in the Greenland shark, *Somniosus microcephalus*, and other selachians, translated by Torben Lundbeck. Copenhagen, 1899. illust. 4°.

Add. 1899.1

Translation of Jungersen, H. F. E., 1898.2

The most extensive treatise on these organs.

— Some facts regarding the anatomy of the genus *Pegasus*. Rept. Brit. Assoc. Adv. Sci., London, 1914, 420-422.

Add. 1914.1

K

K, — Hoe men in straat Madoera vischt. Nederl. Zeewezen, 1906, **5**, 24.
Add. 1906.1

Kaestner, Sándor. Ueber die allgemeine Entwicklung der Rumpf- und Schwanzmuskulatur bei Wirbelthieren, mit besonderer Berücksichtigung der Selachier. Arch. Anat. Phys., (*Anat. Abth.*), 1892, 153–222. 4 pls. 38 figs.
Add. 1892.1

Amphioxus, Petromyzon, and Teleosts also studied.

Kafka, Gustav. Neuere Untersuchungen über den Farbensinn der Fische. Naturw. Wochenschr. 1914, **29**, 465–474. 3 figs.
Add. 1914.1

Referat über 39 Arbeiten.

Kahlenberg, L., & Mehl, H. F. Toxic action of electrolytes upon fishes. Journ. Phys. Chem., 1901, **5**, 113–132.
Add. 1901.1

Translation of Kahlenberg, L., & Mehl, H. F., 1901.1

Kalužskij, N. V. Parasites on the fishes of the Moscow market [Text in Russian] Bull. Soc. Sci. Moscow, 1888, **50**, no. 2, 370–378.
Add. 1888.1

Kaneko, Ichiro. On the *Lepidotrigla* from Nagasaki [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, **1**, no. 1, 13–16.
Add. 1914.1

Kannemeyer, J. [Eels in the Orange River] Trans. S. African Phil. Soc., 1896, **8**, xcvi–c.
Add. 1896.1

Kappers, C. U. Ariens, & Fortuyn, A. B. D. Researches concerning the motor nuclei of the nervus facialis and nervus abducens in *Lophius piscatorius* L. Folia Neurobiol., 1909, **2**, 689–717.
Add. 1909.1

Kappler, August. Sechs Jahre in Surinam oder Bilder aus dem militärischen Leben dieser Kolonie und Skizzen zur Kenntniss seiner sociale und naturwissenschaftliche Verhältnisse. Stuttgart, 1854.
Add. 1854.1

— Surinam, sein Land, seine Natur, Bevölkerung und seine Kultur-Ver-

hältnisse mit Bezug auf Kolonisation. 1887.
Add. 1887.1

Fishes, 140–161.

Károli, János. *Umbra canina* [Marsili] Természet. Füzetek, Budapest, 1882, **5**, 188–191. pl. Add. 1882.1
Résumé in German, p. 274.

Karrig, — Paul und Peter in Mecklenburg [Schilderung des alten Fischerfestes am 29 Juni] Deutsch. Fischerei-Korrespondenz 1912, **16**, 126.
Add. 1912.1

Karwowski, Stanislaw. Bractwo rybaków w. Poznaniu [Die Fischerinnung in Posen] Rocznik Towarzystwa Przyjaciół Nauk, Posen, 1912, **38**. 31 p. — Abstract by H. Bellée, Arch. Fischereigesch., 1914, Heft 2, 145–150.
Add. 1912.1

Kaschkaroff, Daniel N. Materialien zur vergleichenden Morphologie der Fische. Vergleichendes Studium der Organisation von Plectognathi. Bull. Soc. Natural. Moscou, 1914, n. s. **27**, 263–370. 26 figs. 17 pls. Add. 1914.1

— Vorkommen und Typen des vesikulösen Gewebes (blasigen Stützgewebes) bei Fischen. Verh. Anat. Ges. 1914, **28**. vers., 105–123. 13 figs.
Add. 1914.2

— Zur Kenntnis des feineren Baues und der Entwicklung des Knochens bei Teleostiern. I. Die Knochenentwicklung bei *Orthogoriscus mola*. Anat. Anz., 1914, **47**, 113–138. 14 figs.
Add. 1914.3

“Osteoblastenprodukt (ganze Zelle wandelt sich in Grundsubstanz um). Bindgewebefasern keine notwendige Bedingung. Keine prinzipielle Verschiedenheit zwischen zellenreichen und zellenlosen Knochen. Analogie zwischen Knochen und Knorpel.”

Kastchenko, N. Aus welchem Teil des Blastoderms bildet sich der embryonale Körper der Selachier [Text in Russian] Bull. Soc. Sci. Moscow, 1894, **86**, 5–10. — Anat. Hefte (Abth. 2), 1896, **5**, 401, 491.
Add. 1894.1

— Vorläufige Bemerkung über die Segmentierung des Eies der Selachier

[Text in Russian] Bull. Soc. Sci. Moscow, 1894, **86**, 1-4. — Anat. Hefte, 1896, **5** (Abth. 2.), 489-491. Add. 1894.2

Kavraiskii, Theodor Theodorovich. Note on some fishes of the Caucasus and their parasites [Text in Russian] Bull. Soc. Sci. Moscow, 1887, **51**, no. 2, 175-178. Add. 1887.1

— Collection of fishes presented to the zoological museum by Dr. P. A. Burcev [Text in Russian] Bull. Soc. Sci. Moscow, 1890, **67**, no. 1, 10. Add. 1890.1

— Fishes from the collections presented by Dr. V. I. Isaev [Text in Russian] Bull. Soc. Sci. Moscow, 1890, **68**, 17-27. Add. 1890.2

Kayser, F. H. E. Die Fauna der ältesten Devon-Ablagerungen des Harzes. Abh. K. Preuss. Geol. Landesanstalt, etc., 1878, Bd. 2, Hft. 4. Add. 1878.1

Keane, J. F. On blue water; some narratives of sport and adventure in the modern merchant service. London, 1883. 288 p. Add. 1883.1

Much data about habits of sharks.

Kearney, Harold Leslie. On the relative growth of the organs and parts of the embryonic and young dogfish (*Mustelus canis*) Anat. Record, 1914, **8**, 271-297. Add. 1914.1

In general similarity to conditions prevailing in Mammals.

Keeping, W. The fossils and palæontological affinities of the Neocomian deposits of Upware and Brick Hill (Cambridgeshire and Bedfordshire), etc. Cambridge, 1883. xi, 167 p. 8 pls. 8°. Add. 1883.1

Pisces, p. 80-84.

Kegel, Wilhelm. Der Taunusquarzit von Katzenelnbogen. Abh. Preuss. Geol. Landesanst., 1913, n. s. Heft 76, 162 p. 3 figs. 6 pls. Add. 1913.1

A new species of *Machæracanthus* is described.

Keibel, Franz. Die Gastrulation und die Keimblattbildung der Wirbeltiere. Ergebnisse Anat. Entw.-Ges. Wiesbaden, 1900, **10**, 1002-1119. 43 figs. Add. 1900.1

Amphioxus, Cyclostomes, Selachians, Ganoids, and Teleosts.

— Die Entwicklung der äusseren Körperform der Wirbeltierembryonen, etc. 1902. (In Hertwig, O., Handbuch

Entwickelungslehre der Wirbeltiere, vol. i, pt. 2, 1-174. 81 figs. Jena, 1906) Add. 1902.1

Fishes, p. 1-52. 14 figs.

This monograph appeared in 1902.

Keilhack, Friedrich Ludwig Heinrich Konrad. Ueber präglaciale Süsswasserbildungen im Diluvium Norddeutschlands. Zeitschr. Deutsch. Geol. Ges., 1883, **35**, 390-393. Add. 1883.1

Cyprinus carpio, *Perca fluviatilis*, *Esox lucius*, p. 391.

Keiser, W. Untersuchungen über die erste Anlage des Herzens, der beiden Längsgefässstämme und des Blutes bei Embryonen von *Petromyzon planeri*. Jena. Zeitschr. Nat. 1914, **51**, 570-626. 30 figs. 5 pls. — Vierteljahrsschr. Nat. Ges. Zürich, 1914. 58. Jahrg., 269-275. Add. 1914.1

"Mesenchymzellen in ventralen Spaltraum vor der Leberanlage liefern das Material für das Endocard. Zellstrang längs des Randes der Seitenplatte lockert sich und liefert Blutelemente, sowie Gefässendothelzellen."

Keller, C. Das Leben des Meeres. Leipzig, 1895. 300 figs. 16 pls. 8°. Add. 1895.1

Keller, Franz. The Amazon and Madeira rivers; sketches and descriptions from the notebook of an explorer. (n. p.), 1874. 213 p. illust. Add. 1874.1

Fishes, p. 95-102. Fishing with the poison creeper (*Paullinia pinnata* L.)

Keller, Otto. Tiere des klassischen Altertums in kulturgeschichtliche Beziehung. Innsbruck, 1887. ix, 488 p. illust. Add. 1887.1

Kellicott, D. S. On certain crustacea parasitic on fishes from the Great lakes. Proc. Amer. Micr. Soc., 1880, **1**, 3-57. 3 pls. Add. 1880.1

— On certain crustaceous parasites of freshwater fishes. Proc. Amer. Micr. Soc., 1883, **4**, 75-78. Add. 1883.1

— A crustaceous parasite of the "miller's thumb" (*Cottus*). Proc. Amer. Micr. Soc., 1892, **14**, 76-79. Add. 1892.1

Kendall, William C. The pikes: their geographical distribution, habits, culture, and commercial importance. Rept. U. S. Fish Comm. 1887, append. 5. 45 p. 6 figs. Add. 1887.1

Contains an excellent bibliography.

— Notes on sticklebacks. Science, 1902, n. s. **15**, 588-589. Add. 1902.1

Kendall, W. C.

— An annotated catalogue of the fishes of Maine. *Proc. Portland Soc. Nat. Hist.*, 1914, **3**, 1-198. Add. 1914.1

150 species of salt and freshwater fishes are listed. Bibliography and records, p. 101-198.

Kendall, W. C., Smith, H. M., Evermann, B. W., & Cobb, J. N. See **Smith, Evermann, Cobb, & Kendall.**

Kent, Charles Edwin. Rearing black bass. *Forest & Stream*, 1897, **48**, 467. Add. 1897.1

Kent, William Saville. Observations on a suspected hybrid species of trumpeter, and upon other rare fish taken in Tasmanian waters. *Proc. Roy. Soc. Tasmania*, 1886, 117-124. Add. 1886.1

— Notes on the identity of certain Tasmanian fishes. *Proc. Roy. Soc. Tasmania*, 1887, 47-48. Add. 1887.1

— Notes on the Tasmanian "butter fish" (*Chilodactylus mulhalli* Macleay). *Proc. Roy. Soc. Tasmania*, 1887, 42-43. Add. 1887.2

— Preliminary observations on a natural history collection made in connection with the surveying cruise of H. M. S. "Myrmidon" at Port Darwin and Cambridge Gulf in . . . 1888. *Proc. Roy. Soc. Queensland*, 1889, **6**, 219-242. Add. 1889.1

Fishes, p. 220-224; 239-240.

— The markings of fish with relation to their ancestral or phylogenetic origin. *Rept. Aust. Assoc. Adv. Sci.*, 1892, 381-386. Add. 1892.1

— The market-fishes and marine commercial products of Australia. *Scott. Geogr. Mag.*, 1897, **13**, 296-308. Add. 1897.1

Kenworthy, C. J. Food qualities of the tarpum (*Megalops*) *Bull. U. S. Fish Comm.*, 1884, **4**, 80. Add. 1884.1

Kerbert, Coenrad. *Chromatophagus parasiticus* n. g., n. sp. Ein Beitrag zur Parasitenlehre. *Nederl. Tijdschr. Dierk.*, 1884, **5**, 44-58. Add. 1884.1

Original of Kerbert, C., 1886.1.

— Zoölogische bijdragen tot de kennis der Karazee. III. Report on the fishes. (In *Nederlandsche Pool-Expeditie*, 1882-83) *Bijdr. Dierk.*, Amsterdam, 1887, **14**, 53-60. Add. 1887.1

Full title for Kerbert, C. 1887.1

Kerbert, C., Nierstrass, H. F., & Nengermann, A. A. See **Nierstrass, Nengermann, & Kerbert.**

Kessler, Karl Theodorovich [1815-1881] Descriptions of the fish which are met with in the freshwaters of the St. Petersburg Government. [Text in Russian] (In *Natural history exploration of the St. Petersburg Government*, undertaken by the members of the Russian Entomological Society in St. Petersburg. *Russkoe Entomologh. Obsh.*, St. Petersburg, 1864. **1**, sec. 1, Zoological explorations.) Add. 1864.1

— Fishes of the Black and Caspian Seas compared and described [Text in Russian] *Trudui Sankt-Peterb. Obsh. Estest.* [Bull. Soc. Nat., St. Petersburg], 1874. 132 p. pl. 8°. Add. 1874.1

— Fish of Turkestan [Text in Russian] *Imp. Obsh. Lyubit. Estest. Antrop. Etnog., Izvestiya* [Bull. Imp. Soc. Nat. Anthropol. Etnog.], Moscow, 1874, **11**, pt. 3. 4°. Add. 1874.2

For a translation of the introductory portion revised by the author, see Landsdell, H. *Russian Central Asia*. 1885, **2**, append. A. 8°.

— Fish inhabiting freshwater and also occurring in the ichthyological province of the Aral, Caspian and Black seas [Text in Russian] (In *Trudui Aralo-Caspian Expedition. Sankt-Petr. Obsh. Estest.* [Soc. Naturalists St. Petersburg], 1877, pt. 4.) Add. 1877.1

Keyserling, Alexander von. *Wissenschaftliche Beobachtungen auf einer Reise in das Petschora-land.* [im Jahre 1843]. Petersburg, 1846. Add. 1846.1

Describes *Dimeracanthus concentricus* n. g. et n. sp., a Devonian Ichthyodolite.

Keyserling, A. de, Murchison, R. I., & Verneuil, E. de. See **Murchison, Verneuil, & Keyserling.**

Keysselitz, G. Die Entwicklung von *Myxobolus pfeifferi*. *Arch. Protistenkunde*, 1908, **11**, (2. abth.), 272-308 14 pls. 14 figs. Add. 1908.1

Parasite of *Barbus*.

— Ueber ein Epithelioma der Barben. *Arch. Protistenk.*, 1908, **11**, 326-333. 2 figs. 2 pls. Add. 1908.2

Kidder, D. P., & Fletcher, J. C. See **Fletcher & Kidder.**

Kierich, Friedrich. *Jordanella floridae*. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 590-591. Add. 1914.1

Kilborne, F. L. Preliminary note on the lymphatics of the common bull-head, *Amiurus catus* (L.) Gill. Proc. Amer. Assoc. Adv. Sci., 33. meet., 1884 (1885), 529-531. Add. 1885.1

Kilbourne, S. A., & Goode, G. B. Game fishes of the United States. New York, 1879. 20 pls. fol. Add. 1879.1

Consists of 20 colored plates of fishes with descriptive letterpress.

Killinger, Adolf. Ueber das Einlassen der Enten in die Fischwasser. Allgem. Fischerei-Zeitg., 1913, 38. Jahrg., 34-37. Add. 1913.1

Kingsley, John Sterling [1859-] The segmentation of the head. Biol. Lects. Marine Biol. Labor. Woods Hole, 1895 (1896), 137-148. Add. 1896.1

— Additions to recorded fauna of Casco bay [Maine] Proc. Portland Soc. Nat. Hist., 1909, 2, pt. 7. 3 p. Add. 1909.1

Kingsley, Mary H. West African studies. London, 1901, 507 p. pls. Add. 1901.1

Fishing in West Africa, chapter 4. Musical fish, p. 91.

Kirby, William [1759-1850] On the history, habits, and instincts of animals (In the Bridgewater Treatises. London, 1835, 7. treatise, vols. 1 & 2.) Add. 1835.1

Vol. i. Migration of fishes, p. 107-124.

Vol. ii. Locomotive and prehensory organs of fishes, p. 121-123, 135-143; functions and instincts of fishes, p. 371-408. 2 pls.

A new edition, with notes by T. R. Jones, of Kirby's work in 2 vols. was issued at London, 1851-52 (1853). There is also an American edition published at Boston, and a German version appeared at Stuttgart, 1838.

Kirk, Thomas William [1828-1898] On a curious parasite (*Anthosoma smithii*, Leach) from the Porbeagle shark (*Lamna cornubica*). Trans. New Zealand Inst., 1888, 20, 31-33. Add. 1888.1

Kirkaldy, (Miss) J. W. On the species of *Amphioxus*. Rept. Brit. Assoc. Adv. Sci., 1894, 685-686. Add. 1894.1

Kirsch, Philip Henry [-1900] A review of the European and American

Uranoscopidae or star-gazers. Proc. Acad. Nat. Sci. Philad., 1889, 258-265. Add. 1889.1

Kirschner, F. (engraver) I (— XXVII) Tabula triplicis tam ad legendum quam ad vivendum accomodati catalogi universalis, diviso prima; id est, regni animalis tertia classis, pisces ex raii emendata ichthyologia Willughbeii, forma minori descripti, ad illas figuras cum Blochii (Naturalem historiam piscium) et quovis alio opere (Histoire naturelle des Dorades de la Chine, gravées par M. F. Martinet, et accompagnée d'observations . . . par M. de Sauvigny) comparandas cuicunque etiam systemati novisque editionibus applicandas. Tabelle aus den ersten Abtheilung, &c. Augusta Vindelicorum, 1786. obl. fol. Add. 1786.1

This consists of copper plate figures in reduced size of illustrations in the works of Willughby, Bloch, Seba, and others.

Kirtland, J. P. Fishes of Ohio (In The family visitor. Cleveland & Hudson, Ohio, 1850-51) Add. 1850.1

Kiss von Zilah, A. Ueber den schädlichen Einfluss von Mikroorganismen auf die künstliche Forellenzucht. Oester. Monatschr. Thierh., Wien, 1897, 21, 433-435. Add. 1897.1

Kistler, H. E. Fish-fin and other poisons. Forest & Stream, 1899, 53, 112. Add. 1899.1

Kite, J. Alban. Report upon apparatus and facilities needed for hatching Spanish mackerel. Rept. U. S. Fish Comm. 1883 (1885), 11, 1095-1100. 2 figs. Add. 1885.1

Kiwirikko, K. E. See **Stenroos, Karl Emil.**

Klaatsch, Hermann. [Discussion of Rückert's paper on spiral valve of ganoids and sharks] Verhandl. Anat. Gesell., Berlin, 1896, 149. Add. 1896.1

Klapper, P. Süßwasserfische (In Wandtafeln für den zoologischen Unterricht, von O. Schmeil. Stuttgart, 1905. pl. 8°) Add. 1905.1

Klaptocz, B. Cestoden aus Fischen, aus Varanus und Hyrax. (In Ergebnisse der mit Subvention aus der Erbschaft Treitt unternommenen zoologischen Forschungsreise Dr. Franz Werner's in den ägyptischen Sudan und nach Nord-Uganda.) Sitzber. Akad.

Klaptocz, B.

Wiss. Wien, math.-nat. Kl., 1906, **115**,
1. Abth., 121-144. pl. Add. 1906.1

Klein, Michael. Sammlung merkwürdigster Naturseltenheiten des Königsreich Ungarn. Presburg & Leipzig, 1778. 8°. Add. 1778.1

"Paucos pisces nominat nempe Hausen, Stöhr, Forelle Lachs, Lachsfore & Fogo, sed non describit." Walbaum.

Klimenko, W. S. Fish poisoning [Text in Russian] Protok. Zasaed. Kavkazsk. Med. Obsh., Tiflis, 1893-94, **30**, 647-653. Add. 1893.1

— Zur Frage der Vergiftung mit Fischgift. Pharm. Zeitg. Russland, 1894, **33**, 389. Add. 1894.1

Klinge, Walter. *Haplochromis strigigena* Pfeffer (*Paratilapia multicolor*) der "Maulbrüter" und seine Zucht. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 703-704. fig. Add. 1914.1

Klippart, J. H. Catalogue of fishes of Ohio. Rept. Ohio State Fish Comm. 1875-76. Add. 1876.1

Klunzinger, C. B. Erinnerungen aus meinem Leben als Naturforscher und Arzt zu Koseir am Roten Meere. Zool. Annal., 1914, **6**, 223-311. figs. Add. 1914.1

Verzeichnis von Publikationen, p. 304-311.

Knauthe, Karl. Zur Biologie des Karpfens. Korr. Fischzucht, 1896, 117. Add. 1896.1

— Untersuchungen über den Stoffwechsel der Fische. Deutsch. Fischerei Zeitg., 1897-1898, 1-3. Add. 1898.1

— Zur Untersuchung der Fischfuttermittel. Fischerei Zeitg., 1898, **1**, no. 25. Add. 1898.2

— Neuere Erfahrungen in der Fischfütterung. Fischerei Zeitg., 1900, **3**, no. 22-25. Add. 1900.1

Knebel, C. Eenige aantekeningen over de visschery in de afdeeling Grati. Tijdschr. voor Ind. Taal-, Land- en Volkenkunde, 1881, **26**, 283. Add. 1881.1

Knight, N. P. Fishery bait experiments. A report on the comparative merits of different kinds of bait used in cod-fishing along the Gaspé peninsula. Contrib. Canadian Biol. 1906-10 (1912), 23-32. Add. 1912.1

Knoch, Julius [1828-1893] Die künstliche Zucht der Lachse, Lachsforellen, Forellen und der Bastarde derselben, sowie ihre Verpflanzung und Acclimatisation in den Flüssen Welikaja, Pskowa und in dem Pleskauer See. Corresp.-Bl. Riga, 1884, **27**, 1-13. Add. 1884.1

— On poisonous fishes and on the means to prevent poisoning by them [Text in Russian] Voyenno-med. J., St. Petersburg, 1888, **141**, 3. sect., 399. *Ibid.*, **142**, 3. sect., 1; 147; 181. 2 pls. Add. 1888.1

Knoepfel, R. Elektrische Organe bei Fischen. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 82-85. 4 figs. Add. 1914.1

Knox, F. J. Anatomical observations on *Ophisurus novæ zelandæ*, (Hector) Trans. Proc. New Zealand Instit., 1869 (1870), **2**, 35-40. pl. Add. 1870.1

Knox, J. A view of the British Empire, more especially Scotland, with some proposals for the improvement of that country, the extension of its fisheries and the relief of the people. 2 vols. 1785. Add. 1785.1

Vol. i, p. 232, history of the English, Scotch, Dutch and Irish fisheries.
Another edition, 1789.

Knudsen, Henrik. Some facts concerning isinglass. Bull. U. S. Fish Comm. 1885, **5**, 295-297. Add. 1885.1

Knudsen, P. C. Fiskeri i gamle Dage. [Fishing in olden times] Ferskvandsfiskeribladet, 1911, Heft 21, 249. Add. 1911.1

— Gamle meddelelser af Thestrup i Rind Herreds historie fra c. 1725. Ferskvandsfiskeribladet, 1911, Heft 9, p. 101. Add. 1911.2

— Gamle meddelelser om Gaardboe Sø. Ferskvandsfiskeribladet, 1911, Heft 11, 125-126. Add. 1911.3

Kobert, Rudolf [1854-1918] Compendium der praktischen Toxikologie. Stuttgart, 1894. 180 p. Add. 1894.1
Various references to poisoning from eating fish.

Koch, W. Ueber den Nutzen der Fischuntersuchungsstellen. Blätt. Aquar.-Terrar. Kunde, 1913, 24. Jahrg., 391-392. Add. 1913.1

Koch-Grünberg, Theodor. Der Fischfang bei den Indianern Nordwestbrasilens. Globus, 1908, **93**. Add. 1908.1

Köhler, Walther. *Acanthopsis spec.* Wochenschr. Aquar.-Terrar. Kunde, 1904, 1, 155. Add. 1904.1

— *Etwas vom Schlammbeisser.* Blätt. Aquar.-Terrar. Kunde, 1906, 17, 56-57. Add. 1906.1

— *Phractolaemus ansorgii.* Blätt. Aquar.-Terrar. Kunde, 1906, 17, 404. Add. 1906.2

Kölliker, Rudolf Albert von [1817-1905] For memorial notices see Stöhr, P. A. 1906.1. See also Ehlers, E. Albert von Kölliker. Zum Gedächtnis. Zeitschr. Wiss. Zool., 1906, 84, 1-xxvi.

— *Pigmentlose Organe von Chauiodius.* Zeitschr. Wiss. Zool., 1853, 4, 366. Add. 1853.1

— *Untersuchungen zur vergleichenden Gewebelehre (Rochen, Plagiostomen, Anneliden), angestellt in Nizza, im Herbst 1856.* Verh. Phys. Med. Ges. Würzburg, 1857, Bd. 8, Hft. 1, 1-129. 3 pls. Add. 1857.1

— *Untersuchungen über das Ende der Wirbelsäule der lebenden Ganoiden und einiger Teleostier.* Gratulationschrift zur 400jähr. Jubiläumsfeier der Univ. Basel. Leipzig, 1860. 27 p. 4 pls. 4°. Add. 1860.1

Full title for Kölliker, R. A., 1860.3.

— *Kritische Bemerkungen zur Geschichte der Untersuchungen über die Scheiden der Chorda dorsalis.* Verh. Phys. Med. Ges., Würzburg, 1872, N. F. 2. Add. 1872.1

Petromyzon, Sharks, Chimæroids, Teleostomes.

Kölpin, Alexander Bernard [1739-1801] *Fernere Anmerckungen zur Naturgeschichte des Schwertfisches.* König. Schwed. Akad. Abhandl., 1771 (1775), 33, 118-121. pl. Add. 1775.1

Koelreuter, Joh. Gottlieb. [1733-] *Continuatio descriptionis piscium rariorum.* Nov. Comment. Petropol., 1762, 9, 420-470. Add. 1762.1

3 species of fish described.

— *Piscium rariorum descriptiones continuatae.* Nov. Comment. Petropol. 1763, 10, 329-351. Add. 1763.1

4 species of fish described.

— *Observationes in Gado lota institutæ.* Nov. Comment. Acad. Petropol., 1774, 19, 424-434. Abstracts in Erxleb.

Phys. Bibl., 4, 26. — *Comment. Lips.*, 22, 665. Add. 1774.1

— *Descriptio Lerneæ, forsan adhuc incognitæ, Gadi calloriæ L. branchiis firmiter inhærentes descriptio.* Acta. Acad. Palat., 1775, 3, Phys., 57-61. figs. Add. 1775.1

— *Beschreibung des Fisches Nawaga bey den Russen genannt, (Gadus callarias), aus dem Geschlechte der Gadum.* Neu. Hamburg. Magaz., 1777, 107 St., 387-403. Add. 1777.1

See also Koelreuter, J. T., 1769.1.

— *Ueber den Salmo hucho.* Schrift. Naturf. Berlin. Gesellsch., c. 1784, 4, 427. Add. 1784.1

Koenen, Adolf von [1837-1915] *Cocosteus obtusus* von Koenen, aus dem Oberdevon bei Gerolstein. Verh. Nat. Hist. Ver., Bonn, 1886, 43, 55-57. Add. 1886.1

Koenig, Clemens. *Icones fossilium sectiles.* London. 1825. 4°. Add. 1825.1

Describes *Teratichthys antiquitatis* n. g. et n. sp. (p. 4) from Eocene of Sheppey.

König, J., & Splittgerber, A. *Bedeutung der Fischerei für die Fleischversorgung im deutschen Reich.* Mitteilung der Landwirtschaftl. Versuchsstation in Münster. Landw. Jahrb., Berlin, 1909. 177 p. 6 pls. & figs. Add. 1909.1

Kofoid, C. A. *The biological stations of Europe.* Bull. U. S. Bur. Education, Washington, 1910. no. 440. xiii, 360 p. illust. Add. 1910.1

Kofoid, C. A., & Watson, E. E. *On the orientation of Gyrocotyle and of the cestode Strobila.* Proc. 7. Internat. Zool. Congr., Boston, 1907 (1912), 187-191. 3 figs. Add. 1912.1

Parasitic in *Chimæra colliæ*.

Koken, Ernst. *Die Bedeutung der Otolithen und des Gehörorgans für die natürliche Systematik der Fische.* Zeitschr. Deutsch. Geol. Ges., 1891, 43, 154-170. Add. 1891.1

— *Neue Untersuchungen am tertiären Fisch-Otolithen.* II. Zeitschr. Deutsch. Geol. Ges., 1891, 43, 77-153. 10 pls. & 28 figs. Add. 1891.2

Kolikov, N. K. *Das primäre Skelet der Bauchflossen der Teleostier.* Bull. Soc. Nat. Moscou, 1896, 9, 514-522. Add. 1896.1

Kolikov, N. K.

— Metamerie des Kopfes von *Petromyzon planeri*. Anat. Anzeig., 1899, 16, 510-523. Add. 1899.1

Kolmer, W., & Haempel, O. See **Haempel & Kolmer.**

Koninck, L.-G. de [1809-1887] Notice sur les fossiles [carbonifères] de l'Inde découverts par Dr. Fleming. Liège, 1863. 44 p. pls. Add. 1863.1
Saurichthys and Acrodus, p. 4, figs.

— Recherches sur les fossiles paléozoïques de la Nouvelle-Galles du Sud (Australie) Part 3, Fossiles carbonifères. Bruxelles, 1876-77. 230 p. Add. 1876.1

Tomodus convexus. p. 354.

— Descriptions of the Palæozoic fossils of New South Wales: translated by David and Dun. Sydney, 1898. 298 p. 24 pls. 4°. Add. 1898.1
Pisces, p. 281.

Koningsberger, J. C. Java zoologisch en biologisch. Buitenzorg, 1911-15. 663 p. 8°. Add. 1911.1

Issued in 12 parts, 1911-15.
Visschen, p. 380-399; 474-475.

Konstemssow, W. Ueber die Natur des Fischgiftes. Arch. Biol., 1904, 10, 475. — Chemikerzeitg., 1905, Report. 132. Add. 1904.1

Korách, Aladár. Daten zur Ur-fischerei im Komitate Tolna. Anz. Ethnog. Abth. Ungar. Nat. Mus., Ergänzungsheft, Beibl. 1, 1902, 184-186. Add. 1902.1

12 figs. of fishing appliances.

Korschelt, E., Linck, —, Oltmanns, —, & others (editors) Handwörterbuch der Naturwissenschaften. 9 vols. Jena, 1912-14. Add. 1912.1

Kossel, A. Weitere Mitteilungen über die Proteine der Fischspermien. Sitzb. Akad. Wiss., Heidelberg, mat.-phys. Kl., 1913, 7. Abth., 12 p. — Zeitschr. Physiol. Chem., 1913, 88, 163-185. Add. 1913.1

Complete reference for Kossel, A. 1913.1

Kostytscheff, P. Chemical composition of fish products, with some remarks on their nutritive value. Report U. S. Fish Comm. 1886 (1889), 14, 1019-1025. Add. 1889.1

Translation from Russian Journal Rural Economy and Forestry, CXLIV, pt. 2.

Kovalevski, Mieczyslaw. Ueber Furchung und Keimblätteranlage der Teleostier. Sitzber. Phys-Med. Soc. Erlangen, 1885, 18, 1-6. Add. 1885.1

Kracheninnikov, Stefan Petrovich [1713-1755] Histoire et description du Kamtchatka, etc. Translated from the Russian. 2 vols. (in 1) Amsterdam, 1770. Add. 1770.1

Poissons, II, p. 210-257.

See also, Kracheninnikov, S. P., 1764.1 & 1768.1.

Krämer, Augustin. Die Samoa-Inseln. 2 vols. Stuttgart, 1903. 509 & 445 p. 5 pls. 236 figs. sm. fol. Add. 1903.1

Bd. II. Ethnographie: Fishing apparatus and methods, p. 167-202; fishes (native and scientific names with brief descriptions), p. 414-424. A very authoritative work.

— Hawaii, Ostmikronesien und Samoa, meine zweite Südseereise (1897-1899) zum Studium der Atolle und ihrer Bewohner. Stuttgart, 1906. xv, 585 p. illust. Add. 1906.1

For frequent references to fishes and methods of fishing, see his index.

Krätzschar, Alfred. Meine Scheibenbarsche (*Mesogonistius chætodon*) Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 636-638. fig. Add. 1914.1

Král, —, & Dubard, —. Étude morphologique et biologique sur le bacillus tuberculosis piscium. Rev. Tuberculose, Paris, 1898, 129-150. Add. 1898.1

Kramp, E. *Fundulus guentheri* Pfeffer und seine Zucht im Aquarium. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 209-211. 2 figs. Add. 1914.1

— Haplochilus spec. (*H. cameronensis* var.?) aus Gabun und seine Zucht Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 57-59. fig. Add. 1914.2

Kranz, C. A., & Weber, J. C. See **Weber & Kranz.**

Krasper, Erich. *Polycentropis abbreviata* Boulenger. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 650-651. pl. Add. 1914.1

Krause, Edward. Vorgeschichtliche Fischereigeräte und neuere Vergleichsstücke. Globus, 1897, 71, 270. Add. 1897.1

— Vorgeschichtliche Fischereigeräte und neuere Vergleichsstücke. Vergleichende Studie als Beitrag zur

Geschichte des Fischereiwesens. Zeitschr. Fisch. Hilfswissen., Berlin, 1904, **11**, Hefte 3-4. 108 p. 8°. Add. 1904.1

Krause, Wilh. Die Entwicklung der Haut und ihrer Nebenorgane. (In Hertwig, O. Handbuch Entwicklungslehre der Wirbelthiere. Jena, 1906, vol. ii, pt. 1, p. 253-337. 54 figs.) Add. 1906.1

Organs of lateral line, p. 332-337. 3 figs.

Krauss, Christian Ferdinand Friedrich von. Die Goldorfe (*Cyprinus orfus*, L.) Württemb. Jhefte., 1890, **46**, 304. Add. 1890.1

Kreidl, A. Weitere Beiträge zur Physiologie des Ohrlabyrinthes. Versuche an Fische. Sitzber. K. Akad. Wiss. Wien, math-natur. Kl. 1892, **101**, abth. 3, 469-480. Add. 1892.1

— Ein weiterer Versuch über das angebliche Hören eines Glochenzeichens durch die Fische. Arch. Gesammt. Physiol. Bonn, 1896, **63**, 581-586. — Centralb. Physiol., 1896, **10**, 209. Add. 1896.1

Kresz, C. Le pêcheur français, traité de la pêche à la ligne en eau douce. 5th. edition. Paris, 1847. 420 p. 20 pl. portr. Add. 1847.1

Other editions: 1818, 1830, 1861, etc. Westwood and Satchell pronounce it one of the best French works on angling.

Kreyenberg, M. For bibliographical note see Wolterstorff, W. G. 1915.1

Krieger, Maximilian. Neu-Guinea. Berlin [1899] xii, 535 p. illust. (Bibliothek der Länderkunde, vols. v & vi) Add. 1899.1

Fishing in Kaiser Wilhelmsland, p. 162; in British New Guinea, p. 284-285; in Dutch New Guinea, p. 377; 380; 381; 387; 388.

Kříženecký, Jar. Das Hungern als fördernder Faktor der organischen Entwicklung. Nat. Wochenschr., 1914, **29**, 549-552. Add. 1914.1

Förderung oder frühzeitige Hervorrufung der Keimzellenentwicklung durch das Hungern.

Krogh, August. On the influence of the temperature on the rate of embryonic development. Zeitschr. Allg. Physiol., 1914, **16**, 163-177. 8 figs. Add. 1914.1

Algebraic ratios, not van't Hoff's formula.

Krogh, A., & Ege, R. See Ege & Krogh.

Krogh, August, & Johansen, A. C., See Johansen & Krogh.

Krüger, Berthold. Beobachtungen an Zierfischen in der Dämmerung und der Nacht. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 48-49. Add. 1914.1

— Nochmals die Fundorte der *Fitzroya lineata* Jenyns in Argentinien. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 296-297. Add. 1914.2

Krünitz, Joh. Georg [1728-1769] Oekonomische Encyclopædie oder allgemeines System der Land-Haus-und Staats wirtschaft. Berlin, 1773. fig. 8°. Add. 1773.1

"Multa de piscibus, eorumque generatione, educatione, conservatione, præparatione, castatione, captura, instrumentis ad eam aptis, vivariis, piscinis, morbis, & jure piscatorio ex aliis auctoribus conscripsit ordine alphabetico præsertim Tom. 13." — Walbaum.

Krukenberg, C. Fr. W. [1852-1889] Bedenken gegen einige aus neueren Untersuchungen über den Gaswechsel bei Fischen und bei Wirbellosen gezogene Schlussfolgerungen. (In his Vergl. Physiol. Studien Adria. Heidelberg, 1881, **1**, 1. Abth., 160-171.) Add. 1881.1

— Beiträge zur Anatomie und Physiologie von *Luvarus imperialis* Raf. III. Physiologisch-chemische Untersuchungen. (In his Vergl. Physiol. Studien Adria. Heidelberg, 1881, **1**, 4. Abth., 29-64.) Add. 1881.2

Nature of red pigments of epithelium; enzymes in digestive secretions; organic compounds in chemical composition of muscles.

— Die Durchfluthung des Isthmus von Suez in chorologischer, hydrographischer und historischer Beziehung (In his Vergl. Physiol. Studien. Heidelberg, 1882, **2**, 5. Abth., 1-95. 2 pls.) Add. 1882.1

Influence of Suez Canal on intermigrations of Mediterranean and Red Sea faunas.

— Die Pigment der Fischhaut. Das grüne Pigment in den Knochen, Gräten und Schuppen von *Belone rostrata*. (In his Vergl. Physiol. Studien. Heidelberg, 1882, **2**, 3. Abth., 139-143.) Add. 1882.2

— Ueber die chemische Beschaffenheit der Eierschalen von *Mustelus lævis* und (die Schlange) *Tropidonotus natrix*. (In his Vergl. Physiol. Studien. Heidelberg, 1882, **2**, 2. Abth., 89-92.) Add. 1882.3

— Ueber die Verschiedenartigkeit des organischen Substrates der Eierschalen von Wirbelthieren. (In his

Krukenberg, C. F. W.

Vergl. Physiol. Studien. Heidelberg, 1882, 2, 1. Abth., 62-70) Add. 1882.4

Chemical composition of egg capsules of Elasmobranchs.

Kubary, J. S. Ethnographische Beiträge zur Kenntnis des Karolinen Archipels. Veröffentlicht im Auftrage des Kgl. Museums für Volker-Kunde zur Berlin. Leyden, 1889. 307 p. 55 pls. 8°. Add. 1889.1

Heft ii, Theil i, Die Industrie der Pelau-Insulaner, Fischerei, 123-151. pls. xvi-xxi.

Extensive treatise on fishing with spears, nets, hooks, traps, and poisons; on fishing and religion, on noosing sharks. Fish named and the particular apparatus for taking it described. Exhaustive article profusely illustrated.

Kubo, Ino. Ueber die vom Nervus acusticus ausgelösten Augenbewegungen. II. Versuche an Fischen. Arch. Gesamnt. Physiol., 1906, 115, 457-482. 6 text-figs. Add. 1906.1

Petromyzon, 4 selachians, and 2 flounders studied.

Künstler, Joseph. La reproduction naturelle et artificielle du saumon. Rev. Sci., 1889, 43, 359-365. Add. 1889.1

— [L'influence de la lumière électrique sur les Salmonides dans le jeune âge] Mém. Soc. Sci. Bordeaux, 1893, 3, lxii-lxiii. Add. 1893.1

— Sur la plasticité évolutive des salmonides sous l'influence des conditions ambiantes. Bull. Soc. Acclim. France, 1893, 40, 2. sem., 500-502. Add. 1893.2

Kuhl, Heinrich. *Myliobatis ocellatus* = *Ætobatus narinari*. Alg. Konst. Letterb. Haarlem, 1823. Add. 1823.1

Kuiper (junior), K. De functie van de zwemblaas by eenige onzer zoetwatervisschen [Die Funktion der Schwimmblase bei einigen unserer Süßwasserfische] Amsterdam, 1914. 169 p. 8 pls. Add. 1914.1

Kuliabko, A. Quelques expériences sur la survie prolongée de la tête isolée

des poissons. Arch. Internat. Physiol., 1907, 4, 436-464. Add. 1907.1

Kuntz, Albert. The embryology and larval development of *Bairdiella chrysura* and *Anchovia mitchilli*. Bull. Bur. Fisheries 1913 (1914), 33, 3-19. 46 figs. Add. 1914.1

— Notes on the habits, morphology of the reproductive organs, and embryology of the viviparous fish *Gambusia affinis*. Bull. Bur. Fisheries 1913 (1914), 33, 177-190. 4 pls. Add. 1914.2

Kupffer, C. von. [1829-1902] Die Deutung des Hirnanhanges. Sitzber. Ges. Morph. Physiol. München, 1894, [10], 59-87. 11 figs. Add. 1894.1

Kurita, Manjirō. Notes on the perches of China [Text in Japanese] Journ. Geogr. Soc. Tokyo, 1886-87, 8, no. 5, 51-54. Add. 1886.1

— Notes on salmonidæ of north China [Text in Japanese] Journ. Geogr. Soc. Tokyo, 1886-87, 8, no. 6, 61-64. Add. 1886.2

— On the Chondrostei of China [Text in Japanese] Journ. Geogr. Soc. Tokyo, 1886-87, 8, no. 8, 35-38. Add. 1886.3

Kuroda, Chorei. Local names of some Japanese fishes [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 2, 10-12. Add. 1914.1

Kurtze, G. A. Commentatio de petrefactis quæ in schisto bituminoso Mansfeldensi reperiuntur. Halæ, 1839. 36 p. 3 pls. 4°. Add. 1839.1

Kuske, — Der Kölner Fischhandel vom 14.-17. Jahrhundert. Westdeutsche Zeitschr., 1905, 24. Jahrg. Add. 1905.1

Kutschin, O. Ueber den Bau des Rückenmarks von Neunauges. Inaug. Dissert. Kasan, 1863. Add. 1863.1

Abstract by Stieda, L. Arch. Mikr. Anat., 1866, 2, 525-530.

L

L., M. L'industrie de l'huile de sardines. *La Nature*, 1901, **29**, pt. 1, 155. Add. 1901.1

Labbé, Alphonse. Sur deux Coccidies nouvelles, parasites des poissons. *Bull. Soc. Zool. France*, 1893, **18**, 202-204. Add. 1893.1

Labillardière, Jacques Julien de [1755-1834] Relation du voyage à la recherche de "La Pérouse" fait . . . 1791 [-1794] etc. 2 vols. & atlas. Paris an VIII [1800] 8° & fol. Add. 1800.1

— Voyage in search of La Pérouse . . . during the years 1791-1794. 2 vols. London, 1800. Add. 1800.2

I. Remora, p. 72-79; bonitos, 74, 85, 88; sharks 76, 165, 323, 453; flying-fish, 85-86. II, Diodon, 83; scorpena poisonous, 253.

La Blanchère, Pierre R. H. M. du C. de [1821-1880] Le brochet, la perche, la gremille et l'apron. Les trois règnes de la nature, 1864, no. 19, 145-152. 5 figs. Add. 1864.1

— Les cyprins. Les trois règnes de la nature, 1864, no. 42, 329-336. 5 figs. Add. 1864.2

— Les poissons couveurs. Les trois règnes de la nature, 1864, no. 34, 265-272. 4 figs. *Ibid.*, 1865, no. 65, 89-96. 8 figs. Add. 1864.3

— Encore les poissons rouges. Les trois règnes de la nature, 1865, no. 101, 377-392. figs. Add. 1865.1

— La pêche en eau douce. Paris, 1881. 204 p. fig. 12°. Add. 1881.1

La Branche, George M. L. The dry fly and fast water: fishing with the floating fly on American trout streams, together with some observations on fly fishing in general. N. Y., 1914. 218 p. Add. 1914.1

Labtbom, J. (præses) Dissertatio de piscinis. Upsaliæ, 1764. 4. Add. 1764.1

C. Isberg, respond.

Lacaze-Duthiers, H. Prix proposé pour la découverte de la matière

du poison qui se développe dans les poissons, et sur les moyens de la combattre. *Arch. Zool. Expér. Gén. Hist. Nat.*, Paris, 1888, 2. ser. **6**, xlviii. Add. 1888.1

Lacépède, (Comte) Bernhard Germain Etienne de la Ville-sur-Ilion [1756-1825] For biographical notice of Count Lacépède, and account of his work on the natural history of fishes, see *Edinburgh New Phil. Journ.*, 1827, **3**, 267-270.

— Mémoire sur l'organe de la vue du poisson appelé cobète, Anableps. *Bull. Soc. Philom. Paris*, 1797. (Nov.), 57. Add. 1797.1

Lacoste, L. Sérothérapie antivenimeuse des poissons. *Bull. Trim. Enseign. Pêches. Marit. Paris*, 1911, **16**, 435-437. Add. 1911.1

Ladd, Christine. See **Franklin, Christine Ladd**, in vol. I, p. 415.

La Faille, Johan Marcus Baart de. De animalibus phosphorescentibus. Inaug. Dissert. Groningen, 1821. 84 p. Add. 1821.1

Phosphorescent fishes: alive, p. 28; dead, p. 72-78.

Lafite-Dupont, Jean Lucien Alphonse. Note sur le système veineux des Sélaciens. *Trav. Soc. Sci. Stat. Zool. Arcachon*, 1898, 86-93. Add. 1898.1

Lafitte, Jean-Paul. La pêche chez les peuples primitifs. *La Nature*, 1912, **40**, pt. 2, 382-384. 3 figs. Add. 1912.1

Lafont, Alexandre. Journal d'observations faites sur les animaux marins du bassin d'Arcachon pendant les années 1866, 1867, 1868. *Actes Acad. Sci. Belles-Lettres & Arts Bordeaux*, Paris, 1868, 3. sér., 3. ann., 581. 4 pls. Add. 1868.1

Mesures des mouvements respiratoires des poissons; mœurs des poissons.

— Observations zoologiques. *Actes Soc. Linn. Bordeaux*, 1871, 3. sér. **8** (28), 11. Add. 1871.1

Egg-laying of *Syngnathus*; electric discharge of torpedo.

Laguesse, Gustave Edouard. Note sur développement histologique de la rate des poissons. C. R. Soc. Biol. Paris, 1888, 8. ser. 5, 594-595.

Add. 1888.1

— Sur la présence de vaisseaux dans l'épithélium intestinal (chez le Protoptère). C. R. Mém. Soc. Biol. Paris, 1890, 42, 292-293. Add. 1890.1

— Pancréas intra-hépatique chez les poissons. C. R. Soc. Biol., Paris, 1891, 9. ser. 3, 145-146. Add. 1891.1

— Structure du pancréas et pancréas intra-hépatique chez les poissons. C. R. Acad. Sci., Paris, 1891, 112, 440-442. Add. 1891.2

— Sur le développement du mésenchyme et du pronéphros chez les Sélaciens (Acanthias) C. R. Mém. Soc. Biol. Paris, 1891, 43, 861-863.

Add. 1891.3

— Comment se constitue la fibre conjonctive adulte ou faisceau de fibrilles? C. R. Mém. Soc. Biol. Paris, 1914, 76, 235-238. Add. 1914.1

— La structure lamelleuse du tissu conjonctif lache chez la torpille. Archives Anat., Micr. 1914, 16, 67-131. 12 figs. 2 pls. Add. 1914.2

Lamelle élémentaire dérivée de la transformation exoplasmique partielle d'une cellule de mésenchyme aplatie. Symplasme lamellaire hyalin.

Lahille, Fernand. Les Tuniciers sont-ils les ancêtres des vertébrés? Bull. Soc. Hist. Nat. Toulouse, 1888, xcii-xcvi.

Add. 1888.1

— Mortalidad de peces en el Rio de la Plata. Bol. Min. Agr., Buenos Aires, 1912, 1-20. pl. Add. 1912.1

Lamanon, Robert de Paul de. Description de divers fossiles trouvés dans les carrières de Montmartre, près de Paris, et vues générales sur la formation des pierres gypseuses. Journ. Physique, 1782, 19, 173-194. pl. Add. 1782.1

Empreinte de poisson, p. 177-180. fig.

Lamarck, Jean Baptiste, [1744-1829] For a summary of the literature concerning Lamarck and Lamarckism see May, W. 1911.1.

Lambert, T. W. Fishing in British Columbia, with a chapter on tuna fishing at South Catalina. London, 1907. 136 p. Add. 1907.1

Lampe, Martin. Die Fische der Deutschen Südpolar-Expedition 1901-1903. III. Die Hochsee- und Küstenfische. Deutsch. Südpol.-Exped., 1914, 15 (Zool. 7) 201-256. pl. & 7 figs.

Add. 1914.1

Lampert, — Prähistorische Fischerei und Fischereigeräte. Arch. Fischereigesch., 1914, Heft 2, 93-108.

Add. 1914.1

Landau, G. Die Geschichte der Fischerei in beiden Hessen. Zeitschr. Ver. Hess. Gesch., 1865, suppl. 10, 16-.

Add. 1865.1

This gives the place of publication of Landau, G., 1865.1.

Landeck, A. Geschlechtsunterschiede der Zierfische. Blätt. Aquar.-Terrar. Kunde, 1914. 25. Jahrg., 49-67.

Add. 1914.1

Landmark, A. Is sawdust injurious to the fisheries? Rept. U.S. Fish Comm. 1879 (1882), 7, 625-632. Add. 1882.1

— Description of salmon passes. 18. Ann. Rept. Comm. Inland Fisheries Massachusetts, 1883 (1884), 47-55.

Add. 1884.1

Lange, Algot. In the Amazon jungle. Adventures in remote parts of the upper Amazon river, including a sojourn among cannibal Indians. New York, 1912. Add. 1912.1

Candiru, pirarucu, piranha and other fishes, p. 204-217; figs. p. 181; 235; 239.

Langguth, George August. Jo. Pringlius de torpedine. Wittenberg, 1779. 20 p. Add. 1779.1

— Opuscula historiam naturalem spectantia, etc. Wittebergæ, 1784. pls. 4°. Add. 1784.1

Contains considerable data about torpedo, anguilla, and other fishes.

Langguth, Theodore G. Trout culture. Bienn. Rept. Comm. Fisheries & Game Indiana, 1911-12 (1912), 53-67. Add. 1913.1

— The wall-eyed perch, or pike perch. Bienn. Rept. Comm. Fisheries & Game Indiana, 1911-12 (1913), 46-52. Add. 1913.2

Langkavel, B. Scholien und naturhistorische Bemerkungen zu Aristoteles über die Theile der Thiere. Progr. Friedrichs-Wederschen Gymnasium, Berlin, 1863. 35 p. Add. 1863.1

- Langley, J. N., & Sewall, H.** On the changes in the pepsin-forming glands during secretion. *Journ. Physiol. London*, 1879, **2**, 281-301. pl. — *Proc. Roy. Soc., London*, 1879, **29**, 383-388. Add. 1879.1
Stomach of *Gasterosteus*, *Journ.*, p. 290; *Proc.*, p. 385.
- Langrand, E.** Cas d'hermaphroditisme chez le hareng. *Feuille Jeun. Natural.*, 1914, 5. sér. 44. année, 92. fig. Add. 1914.1
- Langsdorff, G. H. von.** Voyages and travels in various parts of the world during the years 1803-07. London, 1813. xxi, 386 p. Add. 1813.1
Fish and fisheries, p. 263-264; 278.
- Langsdorf, K. G.** Methode einen Teich wieder zu besetzen und mit mancherley Fischen zu versehen. *Journ. Oecon.*, 1758, 479. — *Vorräthe Auserl. Aufsätze*. pt. 1, 217. Add. 1758.1
- Lanik, A.** Das Sehen im Wasser. Wie sieht der Fisch die Welt? *Kosmos, Stuttgart*, 1914, 11. Jahrg., 200-203. 5 figs. Add. 1914.1
- Lankester, E. Ray.** Foreign fishery boards. *Nature*, 1886, **34**, 28. Add. 1886.1
- Lankester, E. R., Day, Francis, & Hamilton, Edward.** Report as to stocking Loch Ard with Loch Leven trout. *Trout Preservation Assoc., Glasgow*, 1887. 32 p. Add. 1887.1
- Laporte, Ernest.** Faune ichthyologique du département de la Gironde. *Actes Soc. Linn. Bordeaux*, 1853, 2. sér. **9** (19), 158. Add. 1853.1
Complete reference for Laporte, E. 1853.1.
- Lardier, —.** Hygiène alimentaire; intoxication produite par du thon conservé. *Bull. Méd. Vosges, Rambervillers*, 1891-92, **6**, 80-83. Add. 1891.1
- La Rue, George R.** A revision of the cestode family *Proteocephalidæ*. *Ill. Biol. Monogr.*, 1914. **1**. 1-350. Add. 1914.1
See also, La Rue, G. R., 1911.1
- Lataste, Fernand.** Acclimatation du poisson rouge (*Carassius auratus*) dans le Rio Mapocho de Peñaflor. *Act. Soc. Sci. Chili*, 1894, **4**, lx-lxi. Add. 1894.1
- La Tourette, — de.** Von Krankheiten der Karpen. *Hannöv. Magaz.*, 1771, 223. Add. 1771.1
- Latreille, Pierre André** [1762-1833] Familles naturelles du règne animal exposées succinctement et dans un ordre analytique, avec l'indication de leurs genres. 2nd ed. Paris, 1825. 8°. Add. 1825.1
Fishes, p. 112-143.
A German version is:
—— *Natürliche Familien des Thierreichs*. Weimar, 1827. gr. 8°. Add. 1827.1
- Launette, P.** Sur la pêche de la sardine. *C. R. Acad. Sci., Paris*, 1887, **104**, 373-375. Add. 1887.1
- Laurent, Ch.** Essai géologique sur les terrains qui composent l'isthme de Suez. *Bull. Assoc. Amic. Anciens Elèves Ecoles Arts Métiers, Paris*, 1870. Add. 1870.1
Fossil fishes from Chalouf.
- Lawley, Roberto.** Quattro memorie sopra a resti fossili, *Proemio. Pisa*, 1878. Add. 1878.1
Chiefly of fishes.
- Lawrence-Hamilton, J.** Foul fish and filth fevers. *Bull. U. S. Fish Comm.* 1893 (1894) **13**, 311-334. Add. 1894.1
—— Reforms and improvements suggested for the fisheries of Great Britain and Ireland. *Bull. U. S. Fish Comm.* 1893 (1894) **13**, 293-310. Add. 1894.2
- Layard, Edgar Leopold.** Rambles in Ceylon. *Ann. Mag. Nat. Hist.*, 1853. 2. ser. **11**, 389-391. Add. 1853.1
Fish traps and climbing fish [*Anabas*].
—— (On a ribbonfish (*Gymnetrus*) lately cast ashore at Simon's bay) *Proc. Zool. Soc. London*, 1869, 135. Add. 1869.1
- Layet, Alexandre.** Experimental hygiene; observations on the red flesh of the codfish. *Bull. U. S. Fish Comm.* 1887, **7**, 90-95. Add. 1887.1
- Layet, A., Artigalas, —, & Ferré, G.** Note sur le rouge de la morue. *Rev. San., Bordeaux*, 1886, **3**, 49-51. Add. 1886.1
- Lea, Einar.** On the methods used in the herring investigations. *Conseil Perm. Intern. Explor. de la Mer, Public. de Circonstance*, 1910, no. 53, 7-174. Add. 1910.1
—— Murænoid larvæ (In Report on the scientific results of the "Michael

Lea, E.

Sars' North Atlantic deep sea expedition 1910 carried out under . . . the superintendence of Sir John Murray and Dr. Johan Hjort. Bergen, 1913, **3**, pt. 1. Zoology. 59 p. 37 text-figs. 6 pls. 4°.) Add. 1913.1

Leach, J. A. Species of Victorian lampreys. Rept. Brit. Assoc. Advanc. Sci., London, 1914, 399. Add. 1914.1

Leach, William E. Zoological miscellany; being descriptions of new or interesting animals. 3 vols. London, 1814-17. col. pls. Add. 1814.1

I. 1814. Xiphias, p. 61-63, pl. 27: Hippocampus, p. 103-105, fig. 47.

II. 1815. Lepidopus, p. 7. pl. 62.

III. 1817. Leptocephalus, p. 10.

Leary, John L. Construction of ponds and pond-culture methods. Amer. Fish-culturist, 1905, 23-25. — Rept. Ill. Fish Comm. 1902-04, 41-43.

Add. 1905.1

— The sunfish. Trans. Amer. Fisheries Soc. 1910 (1911), 149-152.

Add. 1911.1

Lebailly, C., & Duboscq, O. See **Duboscq & Lebailly.**

Lecoq, Henri [1802-1871] Les époques géologiques de l'Auvergne. 2 vols. Paris, 1867. Add. 1867.1

Cyprinid fossils from Menat, vol. II, p. 577.

Lednev, N. M. Die Fauna [Miocene] der Fischschichten der Halbinsel Apscheron. [Text in Russian] Mem. Comm. Geolog., Petrograd, 1914, n. s. **80**, 1-41. 5 pls. Add. 1914.1

Résumé in German, pp. 42-64.

Lee, F. S. Ueber den Gleichgewichtssinn. Centralbl. Physiol., 1892, **6**, 508-512. Add. 1892.1

Lee, J. E. Structure of the scales of Lepidotus and Lepidosteus. Geologist, 1860, **3**, 458-459. pl. Add. 1860.1

— Notice of a pteraspidan cephalic plate from the Devonian beds of Gerolstein in the Eifel. Geol. Mag., 1882, 2. dec. **9**, 104. pl. Add. 1882.1

Lee, Leslie A. The fishes of Casco bay. [Read before Portland Natural History Society] Portland Advertiser, March 3, 1885. — Brunswick Telegraph, March 13, 1885. Add. 1885.1

Lee, Rosa M. Scales of fish as tests of age [Abstract] Nature, 1913, **91**, 273. Add. 1913.1

Leetham, Constance, & Gardner, John Addyman. See **Gardner & Leetham.**

Lefebvre, Alph. Récolte d'œufs de saumons à l'île Ste-Aragone. Bull. Soc. Linn. Nord France, Amiens, 1886, **8**, 89-92. Add. 1886.1

Lefevre, George, & Curtis, W. C. Experiments in the artificial propagation of fresh-water mussels. Proc. 4. Intern. Fish. Cong., Washington, 1908. Bull. U. S. Bur. Fish., 1908 (1910), **28**, part 1, 615-626. Add. 1910.1

Attachment of glochidia to fish.

Legendre, R., & Fage, L. See **Fage & Legendre.**

Legge, (Col.) William Vincent. Note on the voracity of the kelp fish. Proc. Roy. Soc. Tasmania, 1892, 78.

Add. 1892.1

Lehmann, Adalbert. Ueber sympathische Färbung und die Pigmentbildung bei Barsch und Forelle. Inaug. Dissert. Vet.-Med. Fakultät, Bern, 1906. Add. 1906.1

Lehner, Stephan. Fishing methods and charms (In Neuhauss, R., Deutsch Neu Guinea, vol. iii, p. 439-441; 454-455. Berlin, 1911) Add. 1911.1

Spears, hooks, poisons, spider-web lure, charms at Bukaua.

Le Hon, Henri [1809-1872] Préliminaires d'un mémoire sur les poissons tertiaires de Belgique. Bruxelles, 1871. 15 p. text ill. Add. 1871.1

Leidy, Joseph [1823-1891] For memorial notice see Minot, C. S. 1913.1.

— Contributions to helminthology. Proc. Acad. Nat. Sci. Philad., 1858 (1859), **10**, 110. Add. 1858.1

— Memoir on the extinct reptiles of the Cretaceous formations of the United States. Smithson. Contributions, 1865, **14**, 1-135. pls. Add. 1865.1

Describes Tomodon, new genus; *T. horrificus* n. sp., type, considered to be a reptile tooth. Preoccupied; replaced by *Diplotomodon* in Leidy, J., 1868.2.

— Observations on ichthyodorulites and on certain fossil mammalia. Proc. Acad. Nat. Sci. Philad., 1870, **22**, 12. Add. 1870.1

— Observation on a mouthless fish. Proc. Acad. Nat. Sci. Philad., 1875, **27**, 124-125. Add. 1875.1

- Fish remains of the Mesozoic red shales. *Proc. Acad. Nat. Sci. Philad.*, 1876, **28**, 81. Add. 1876.1
- *Bothriocephalus latus*. *Proc. Acad. Nat. Sci. Philad.*, 1879 (1880), **31**, 40. Add. 1879.1
- Notice of a Tetrarhynchus. *Proc. Acad. Nat. Sci. Philad.*, 1879 (1880), **30**, 340. Add. 1879.2
- A crustacean parasite of the red-snapper. *Proc. Acad. Nat. Sci. Philad.*, 1888 (1889), **40** (3. ser. **18**), 138–139. fig. Add. 1888.1
- Distinctive characters of *Odonaspis littoralis*. *Proc. Acad. Nat. Sci. Philad.*, 1888 (1889), **40**, 162–164. Add. 1888.2
- Parasitic crustacea. *Proc. Acad. Nat. Sci. Philad.*, 1888 (1889), **40**, 165. Add. 1888.3
- Parasites of *Mola rotunda*. *Proc. Acad. Nat. Sci. Philad.*, 1890, **42** (3. ser. **20**) 281–282. Add. 1890.1
- A parasitic copepod. *Proc. Acad. Nat. Sci. Philad.*, 1889 (1890), **41**, 95. Add. 1890.2
- Researches in helminthology and parasitology. *Smithson. Misc. Colls.*, 1904, **46**. Add. 1904.1
- Lemnius, Canut.** De Lapponibus Finmarchiæ, eorumque lingua, vita & religione pristina commentatio, una I. E. Gunneri notis & E. I. Ienssœnii tractatu de singulari Finnum, Lapporumque Norwegii religione pagana. [Text in Danish and Latin] Hafniæ, 1767. 101 pls. 4°. Add. 1767.1
Chapter 13 contains data about various fishes.
- Lendenfeld, R. von.** Zur physiologischen Bedeutung der Luftsäcke. *Biol. Centralb.*, 1897, **17**, 439–440. Add. 1897.1
- Lenhart, C. H., & Marine, David.** See **Marine & Lenhart**.
- Lenhossék, Michael von.** Die Endknospen der Barbe und des Aales. (In his Beiträge zur Histologie des Nervensystems und der Sinnesorgane. Wiesbaden, 1894. 190 p. pls. 8°.) Add. 1894.1
- Lennier, Gustave.** Sur le Zée à épaule armée (*Zeus pungio*, Cuv. et Val.) *Bull. Soc. Linn. Normandie*, Caen, 1895, **9**, 51–52. Add. 1895.1
- Lenz, Harald Othmar.** Zoologie der alten Griechen und Römer, deutsch im Auszugen aus deren Schriften nebst Anmerkungen. Gotha, 1856, 656 p. 12°. Add. 1856.1
Fishes, p. 479–522.
- Lenz, O.** Petrefakten von der Loango-Küste (Landana) (West Afrika) *Verhandl. K. Geol. Reichsanstalt*, 1877, 279; *ibid*, 1883, 230. Add. 1877.1
- Lepechin, Ivan Ivanovich** [1737?–1802] *Descriptiones avium et piscis. Cyprinus corpore olivaceomaculis fuscis distincto, ima corporis parte cinabarina pinna ani radiis septem.* *Nov. Comment. Acad. Petropol.*, 1770, **15**, (hist.) 38; (mem.) 485. Add. 1770.1
- Lereboullet, (Dominique) Auguste** [1804–1865] *Anatomie comparée de l'appareil respiratoire dans les animaux vertébrés.* Strasbourg & Paris, 1838. 156 p. pl. Add. 1838.1
Fishes, p. 89–103; 116–154.
- *Recherches sur l'anatomie des organes génitaux des animaux vertébrés.* *Nov. Act. Acad. Caes. Léop. Carol. Nat. Cur.*, 1851, **21**, pt. 1. Add. 1851.
- Leriche, Maurice.** Observations sur le Gedinnien aux abords du massif Cambrien de Serpont. (Pteraspis) *Bull. Soc. Belge Géol., Palæontol. Hydrol.*, 1912, **26**, 4–7. Add. 1912.1
- Les gisements de poissons Paléocènes et Eocènes de la côte occidentale d'Afrique. *Ann. Mus. Congo Géol.*, 1913, 3 sér. **1**, 81–91. 3 figs. map. Add. 1913.1
- Sur les coques d'oeufs des chiméridés fossiles et, en particulier, sur une coque provenant du jurassique supérieur de Verdun (Meuse) *Ann. Soc. Roy. Zool. Malacol. Belgique*, 1914, **48**, 145–149. 3 pls. Add. 1914.1
- Le Roux, Marc François Julien.** Recherches sur le système nerveux des poissons. *Rev. Sci.*, 1889, **44**, 278–279. Add. 1889.1
- Lesson, René Primevère** [1794–1849] *Zoologie* (In Duperrey, L. I. Voyage autour du monde — sur la corvette . . . "La Coquille," pendant . . . 1822–25. Paris, 1830. 4°.) Add. 1830.1
Poissons: t. II, pt. 1, p. 86–238; atlas, 58 pls. in fol.
Text and atlas in separate volumes.

Lesueur, Charles Alexandre [1778–1846] For biographical notes see Jordan, D. S. 1895.5; Vaillant, L. 1896.2

— Description de plusieurs espèces nouvelles de poissons et de poulpes d'Amérique septentrionale. Journ. Acad. Sci. Nat. Philad., 1824. 6 p. 2 pls. Add. 1824.1

Leuchs, Johann Carl [1797–] Vollständige Anleitung zur Mästung der Thiere; oder Theorie der Viehmästung, mit Anwendung auf Mästung des vierfüßigen Haushaltungsviehes, des Geflügels, der Fische, Krebse, Frösche, Schildkröten, Austern und Schnecken. Eine . . . Preisschrift. Nürnberg, 1817. xvi, 232 p. 8°. Add. 1817.1

Leuckart, C. G. F. R., & Bergmann, Carl. See **Bergmann & Leuckart.**

Levander, Kaarlo Mainio. Ichthyologische Beiträge . . . Unterwirkung von . . . K. M. Levander, &c. 3 parts. Acta Soc. Fauna Flora Fenn., 1900–02, 20, no. 1; *Ibid.*, 22, no. 2 & 4. 8°. Add. 1902.1

Levi-Morenos, David. L'aquicoltura in Torre di Zuino (Friuli). Neptunia, Venezia, 1903, 18, 169–199. figs. pl. Add. 1903.1

— Note tecniche per l'utilizzazione del suolo aqueo. Neptunia, Venezia, 1903, 18, 25–29. Add. 1903.2
Aquiculture.

— Origine ed evoluzione della pesca. Neptunia, Venezia, 1904, 19, 3–8; 49–55. Add. 1904.1

Lewes, G. H. Aristotle: a chapter from the history of science, including analyses of Aristotle's scientific writings. London, 1864. 8°. Add. 1864.1
Translated into German by J. V. Carus. Leipzig, 1865.

Lewis, Meriwether, & Clark, William. Original journals of the Lewis and Clark Expedition 1804–1806, etc. Edited . . . by Reuben Gold Thwaites. 7 vols. & atlas. New York, 1905. Add. 1905.1
References to fishes in index in vol. VII.

Leydig, Franz [1821–1908] Zur Anatomie und Histologie der *Chimæra monstrosa*. Arch. Anat. Physiol. Wiss. Med., 1851, 10, 241–272. pl. Add. 1851.1

— Zoologisches — Kleinere Mittheilungen zur thierischen Gewebelehre [Fishes — Raja] Arch. Anat. Phys., 1854, 314–329. pl. Add. 1854.1

— Lehrbuch der Histologie des Menschen und der Thiere. Frankfurt, 1857. 551 p. 271 figs. Add. 1857.1
Internal structure of uterus in selachians.

— Ueber organe eines sechsten Sinnes. Verhandl. K. Leop.-Car. Deutsch. Akad. Naturf. (Nova Acta) 1868, 34, 1–108. 5 pls. Add. 1868.1
Lateral line canal.

Lidth de Jeude, Theodor Willem van. Catalogue du Musée Zoologique de . . . T. G. van Lidth de Jeude . . . Partie I, II, & IV, contenant les collections de mammifères, d'oiseaux et de poissons, &c. Utrecht, 1858. viii, 155 p. 8°. Add. 1858.1
A sale catalogue.

Liebe, W. Zur Biologie der Fortpflanzung von *Glaridichthys januarius* und *G. decemmaculatus*. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 68–74. figs. Add. 1914.1

Liebig, Theodor. Chanchitozucht. [Heros.] Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 647–648. fig. Add. 1914.1

— Wie züchte ich mit Erfolg gute Schleierfische? Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 493–495. 2 figs. Add. 1914.2

Liégard, Léon. Présence d'anguilles dans des nappes d'eau souterraines et modifications entraînées par ce genre de vie dans l'organe de la vision. Bull. Soc. Linn. Normandie, Caen & Paris, 1869–70 (1870), 2. sér. 5, 25. Add. 1870.1

Liégey, — Note relative au poisson d'eau douce. Vosges Soc. Emul. Ann., 1886, 407–426. Add. 1886.1

Lieventhal, E. Ueber alkaloidartige Körper im gesalzenen Störfleisch. Pharm. Zeitschr. Russland, 1886, 25, 571–576. Add. 1886.1

Lilljeborg, W. [1816–] For bibliographical notice see Hulth, J. M., 1896.1.

Linck, — Oltmanns, — Korschelt, E., & others (Editors) See **Korschelt, Linck, Oltmanns & others.**

Linck, Heinrich Friedrich. Versuch Einer Entheilung der Fische nach den zähnen. Mag. Neuste Phys. Naturgesch. 1789, 6, pt. 3, 28-38. Add. 1789.1

Lindsley, James H. Catalogue of the fishes of Connecticut, arranged according to the natural families. Prepared for the Yale Natural History Society. Amer. Journ. Arts & Sci., 1844, 47, 55-80. Add. 1844.1

Lingard, Alfred. A short account of the various trypanosomata found to date in India in the blood of some of the lower animals and fish. Indian Med. Gaz., Calcutta, 1904, 39, 445-447. Add. 1904.1

Abstract in Journ. Trop. Med., London, 1905, 8, 61.

Linnæus, Carl von [1707-1778] Cyprinus pinnâ ani duplici, cauda trifurca descriptus. Analect. Transalpin. Venice, 1762, 1, 83. Add. 1762.1

See also Linnæus, C. Pre-Linn. 1744.1.

— Museum Adolphi Frederici . . . in quo animalia rariora imprimis & exotica . . . pisces describuntur, etc. Holmiæ, 1764. 110 p. 12°. Add. 1764.1

Issued with Museum Ludovicæ Ulricæ Reginæ.

— Natuurlyke historie der visschen. Amsterdam, 1764-65. 14 pls. 8°. Add. 1764.2

— Mantissa plantarum altera generum editionis VI & specierum II. Holmiæ, 1771. iv, 143-510 p. 8°. Add. 1771.1

Trigla minuta, *T. carolina*, & *Exocoëtus exilis*, described.

Linstow, Otto Fr. Bernh. von. Ueber den Bau und die Entwicklung von *Tænia longicollis*, Rud. Ein Beitrag zur Kenntniss der Fischtänien. Jena. Zeitschr., 1891, 25, 565-576. Add. 1891.1

— *Bothriocephalus ligula* Mon., ein gefährlicher Fischparasit des Müggelsee's. Zeitschr. Fischerei Charlottenburg, 1896, 4, 161-165. Add. 1896.1

Abstract in Centralb. Bakteriolog. Parasitenk., Jena, 1897, 21 (Abth.1), 814.

— Neue und bekannte Helminthen. Zool. Jahrb. (Syst. Abth.) 1906-(1907), 24, 1-20. 18 figs. Add. 1906.1

Linstow, Otto von, & Gemmill, James F. See **Gemmill & Linstow.**

Linthicum, J. Charles. Protection of our food fish. Congressional Rec., Washington, (Oct. 17) 1913, 15 p. (reprint) Add. 1913.1

Linton, Edwin [1855-] Notes on cestoid entozoa of marine fishes. Amer. Journ. Sci., 1889, 37, 239-240. Add. 1889.1

— Notes on larval cestode parasites of fish. Proc. U. S. Nat. Mus., 1897, 19, 787-824. 8 pls. Add. 1897.1

— Notes on *Calyptribothrium*, a cestode genus found in the torpedo. Proc. U. S. Nat. Mus., 1907, 32, 275-284. 7 figs. Add. 1907.1

— Preliminary report on animal parasites collected at Tortugas, Florida, June 30 to July 18, 1906. 5. Yearbook, Carnegie Instit. Washington, 1906, (1907), 112-117. Add. 1907.2

Parasites of fishes.

— Helminth fauna of the Dry Tortugas. Papers Tortugas Lab. Carnegie Instit. Washington, 1908, 1, 157-190. 11 pls. Add. 1908.1

Cestode parasites of fishes.

— Notes on parasites of Bermuda fishes. Proc. U. S. Nat. Mus., 1908, 33, 85-126. 15 pls. Add. 1908.2

— Preliminary report on animal parasites. 6. Yearbook, Carnegie Instit. Washington, 1907, (1908), 114-117. Add. 1908.3

— Helminth fauna of the Dry Tortugas. II. Trematodes. Papers Tortugas Lab. Carnegie Instit. Washington, 1910, 4, 13-98. 28 pls. Add. 1910.1

Trematode parasites of fishes.

Publication 133, Carnegie Instit. Washington

— On the seasonal distribution of fish parasites. Trans. Amer. Fisheries Soc., 1914, 48-56. Add. 1914.1

Lipp, Francis Joseph (of Eutingen) (respond.) Dissertatio inauguralis medica de piscibus venenatis, sectio prima continens enumerationem generum et specierum, additis veneficii exemplis, quam . . . submittit F. J. Lipp, &c. Tubingæ, 1829. 31 p. 8°. Add. 1829.1

H. F. Autenrieth, præses.

List, Joseph Heinrich. Das Cloakenepithel von *Scyllium canicula*. Sitzb. Kais. Akad. Wiss. Wien, 1884, 90, 3. abth., 159-170. pl. Add. 1884.1

List, J. H.

— Untersuchungen über das Cloakenepithel der Plagiostomen. Sitzb. Akad. Wiss. Wien. math.-naturwiss. Cl., 1885-86 (1886), **42**, 3. abth.

Add. 1886.1

i. Das Cloakenepithel der Rochen. pp. 270-305. 4 pls.

ii. Das Cloakenepithel der Haie. pp. 412-438. 3 pls.

List, Theodor. Beiträge zur Geschichte der Fischerei und Teichwirtschaft in Hessen-Darmstadt. Arch. Hess. Gesch. Altertumskunde, 1912, n. s. **8**, Heft 2, 172-198. —. Abstract by J. Schultze in Arch. Fischereigesch., 1913, Heft 1, 210.

Add. 1912.1

Liversidge, A. [An analysis of the pseudoamniotic fluid of *Mustelus antarcticus*] Trans. Proc. New Zealand Instit., 1889 (1890), **22** (n. s. **5**), 332-333.

Add. 1890.1

Livingstone, David [1813-1873] Missionary travels and researches in South Africa, etc. New York, 1858. 732 p. illust.

Add. 1858.1

Fishes in Zanga river, p. 86. Fresh-water flying-fish in river Leeambye, p. 259. Migration of catfish during wet season, p. 283, 336. Fishing with trap, hooks, and poison in Central Africa, pp. 336-337.

— The last journals of David Livingstone in central Africa from 1865 to his death [in 1873], edited by Horace Waller. 2 vols. London, 1874.

Add. 1874.1

Numerous incidental references to fishes. I, p. 244, native names of 39 species of fish in Lake Moera. II, p. 17, Oral gestation of fishes in Tanganyika.

In another edition, New York, 1875, are noted: Oral gestation in the "dagala," probably *Haplochilus tanganicus*, p. 297; various fishes, p. 88, 90, 281, 251, 503.

Livingstone, David, & Livingstone, Charles. Narrative of an expedition to the Zambezi and its tributaries . . . 1858-1864. New York, 1866. 638 p. ill. map.

Add. 1866.1

Habits of catfish, p. 323. Native names of fishes below falls Zambesi, p. 324. Sawfish in freshwater, 324; 366. Habits of *Periophthalmus*, p. 363. Poisoning fish with Busungu plant, *Dirca palustris*, p. 365. Fishing with weirs and baskets in Lake Nyassa, p. 395; with baskets, p. 462; with hand nets, p. 531.

Ljungman, Axel Vilhelm. Die Härings-Fischerei. Die Abhängigkeit des Härings von äusseren physikalischen und biologischen Verhältnissen. Stettin, 1880. 52 p.

Add. 1880.1

— Sweden at the Grand International Fishery Exposition at London,

1883. Bull. U. S. Fish Comm. 1883, **3**, 231-239.

Add. 1883.1

Lloyd, L. Scandinavian adventures, during a residence of upwards of twenty years; representing sporting incidents, and subjects of natural history, and devices for entrapping wild animals. With some account of the northern fauna. 2 vols. London, 1854. 12 pls. & map. 8°.

Add. 1854.1

Vol. i (p. 21-249) contains chapters on: — Varieties of fish; Ichthyologists; Common perch; Three-spined stickleback; Ten-spined stickleback; Common carp; *Cobitis fossilis*; Pike; Salmon; Salmon and trout-fishing; Fishing rights, etc.

Lloyd, W. A. The royal aquarium and winter garden society at Westminster. Zoologist, 1875, 2. ser. **10**, 4301-4302.

Add. 1875.1

Lockwood, Samuel. Fungi affecting fishes — an aquarium study. I, Saprolegnia; II Devœa. Journ. N. Y. Micr. Soc., 1890, **6**, 67-85. 4 pls.

Add. 1890.1

Locy, William A. Primitive metamorphism in selachians, Amphibia and birds. Science, 1895, **1**, 68-69.

Add. 1895.1

Loeb, Jacques [1859-] Ueber die Antheil des Hörnerven an den nach Gehirnverletzung auftretenden Zwangsbewegung, Zwangslagen und assoziierten Stellungsänderungen der Bulbi und Extremitäten. Arch. Gesammt. Physiol., 1891, **50**, 66-80.

Add. 1891.1

Scyllium canicula experimented on.

— Ueber Geotropismus bei Thieren Arch. Gesammt. Physiol., 1891, **49**, 175-189.

Add. 1891.2

Experiments on *Scyllium canicula*.

— Ueber die relative Empfindlichkeit von Fischembryonen gegen Sauerstoffmangel und Wasserentziehung in verschiedenen Entwicklungsstadien. Arch. Gesammt. Physiol., 1893-94, **55**, 530-541.

Add. 1893.1

— Untersuchungen über die physiologischen Wirkungen des Sauerstoffmangels. Archiv. Physiol., 1895 (1896), **62**, 249-294. 2 pls., 25 figs.

Add. 1896.1

Segmentation stages and embryos of *Ctenolabrus* and *Fundulus*.

— On the heredity of the marking in fish embryos. Biol. Bull. Woods Hole, 1898, **6**.

Add. 1898.1

— Die Abhängigkeit der relativen Giftigkeit von Na und Ca von der

- Natur des Anions.** Biochem. Zeitschr., 1912, **39**, 194-199. Add. 1912.1
Nach Versuche an Fundulus.
- The blindness of the cave fauna and the artificial production of blind fish embryos by heterogeneous hybridization and by low temperatures. Biol. Bull. Woods Hole, 1915, **29**, 50-67. 13 figs. Add. 1915.1
- Loeb, Jacques, & Ewald, W. F.** Die Frequenz der Herztätigkeit als eindeutige Funktion der Temperatur. Biochem. Zeitschr., 1913, **58**, 177-185. Add. 1913.1
In Beziehung zum Massenwirkungsgesetz. Fundulus.
- Loeb, Jacques, & Wasteneys, Har-
dolph.** Weitere Versuche über die Entgiftung von Säure durch Salze. Biochem. Zeitschr., 1912, **39**, 167-173. Add. 1912.1
Versuche mit CO₂ an Fundulus.
- Lönnberg, A. J. E.** Ein neuer Bandwurm (*Monorygma chlamydose-
lachi*) aus *Chlamydoselachus anguineus*, Garman. Archiv. Mathem. Natur-
vidensk., 1898, **20**, no. 2. 8°. Add. 1898.1
- Lörenthey, Imre.** Neuere Beiträge zur Stratigraphie der Tertiärbildungen der Umgebung von Budapest. Nebst einigen Bemerkungen zu Julius Hala-
váts "Die neogenen Sedimente der Umgebung von Budapest." Math. Nat. Ber. Ungarn, 1913, **27**, 282-394. 6 figs. Add. 1913.1
- Löschner, Hans.** Ueber die Anlage von Fischwegen. Oesterreich. Fischerei Zeitung, 1908, **5**, no. 7-10. Add. 1908.1
- Lösslein, F.** Schuppensträube bei Bastarden. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 102-103. Add. 1914.1
- Löwe, Johann Carl Christian** [- 1807] Vermischte naturhistorische Bemerkungen. Hallische Naturf. Ge-
sell., 1783, **1**, 121; 133. Add. 1783.1
"Eine Spielart von Karpen."
- Logan, L. B.** Practical carp-culture. Youngstown, Ohio, 1888. 129 p. pl. ills. 8°. Add. 1888.1
- Lohest, Marie Joseph Maximin** [1857-]. Résultats géologiques fournis par l'étude des poissons paléo-
zoïques de Belgique. Ann. Soc. Géol. Belg., Liège, 1888, **15**, 31 p. 8°. Add. 1888.1
- Loman, J. C. C.** *Petromyzon dorsatus* uit Noord-Amerika. Tijdschr. Nederl. Dierk. Vereen, 1914, 2 ser., **13**, iii-iv. Add. 1914.1
- Longhurst, B. W.** Stingingfish. Brit. Med. Journ., 1908, **2**, 146-147. Add. 1908.1
Unknown percoid fish at Gibraltar.
- Longley, W. H.** Report of investi-
gation of color of gulf-weed fauna and of reef fishes. 12. Yearbook Carnegie Instit. Washington, 1913, 177-178. Add. 1913.1
— Report upon color of fishes of the Tortugas reefs. 13. Yearbook Car-
negie Instit. Washington, 1914, 207-208. Add. 1914.1
- Longworthy, Charles F.** Fish as food. Farmer's Bull., no. 85, U. S. Dept. Agriculture, Washington, 1898. 30 p. Add. 1898.1
- Looss, A.** Die Distomen unserer Fische und Frösche. Bibl. Zool. Stutt-
gart, 1894, **6**, Hft. 16. 296 p. 9 pls. 4°. Add. 1894.1
- Lord, Percival Barton** [1808-1840] Pisces, with supplementary additions [by P. B. Lord] (In Cuvier, G. L. C. F. D. The animal kingdom . . . with ad-
ditional descriptions by E. Griffith, &c. 1830. **10**, 8°.) Add. 1830.1
- Loudon, W. J.** The small-mouthed bass. Toronto, 1910. 103 p. pls. ills. Add. 1910.1
- Lourich, Giovanni.** Lettera apolo-
getica di G. Lourich al S. Ant. Lorgna in cui si confutano varie censure fatte alle sue osservazioni sopra diversi pezzi del viaggio del A. Fortis. 1776. 15 p. 4°. Add. 1776.1
Abstract in Gött. Gel. Anz., 1777, 507.
- Osservazioni sopra pezzi del viaggio in Dalmazia del Abb. Fortis. Venezia, 1776. 264 p. 4°. Add. 1776.2
- Low, Johan.** Modus lutram vivam captandi, et pisces adportandi artem edocendi. Analect. Transalpin. 1762, **2**, 424-427. Add. 1762.1
See also Low, J., Pre-Linn. 1752.1.
- Lowe, Percy R.** A naturalist on desert islands. London & New York, 1911. xii, 230 p. illust. 8°. Add. 1911.1
Sharks and other fishes at Swan island, Gulf of Mexico, p. 66-82.

Lowe, R. T. List of a collection of fishes formed on the coast of Madeira, and presented to the Society. Proc. Zool. Soc. London, 1832, 139.

Add. 1832.1

Lowell, James Russell. Success of the United States exhibit at the London International Fisheries Exhibition. Bull. U. S. Fish Comm. 1883, 3, 447-448.

Add. 1883.1

Lower, William I. The cisco of the deeper water lakes of Indiana. Bienn. Rept. Comm. Fisheries & Game Indiana 1911-12 (1913), 21-28.

Add. 1913.1

Lowndes, William Thomas. The bibliographer's manual of English literature. (New edition, revised and enlarged.) 4 vols. London, 1864. 3026 p. & appendix.

Add. 1864.1

Very valuable for English editions and versions.

Lowrey, Anna. A study of the submental filaments considered as probable electric organs in the gymnotid eel, *Steatogenys elegans* Steindachner. Journ. Morphol., 1914, 24, 685-694. 4 figs.

Add. 1914.1

No adipose tissue but resemblance with electroplaxes. Myotome region without electric tissue.

Lowry, Joseph Wilson [1803-1879] Tabular view of British fossils stratigraphically arranged. Compiled and engraved by J. W. Lowry. London, 1853. 4 pls.

Add. 1853.1

Some fishes are included.

For the authorship of this work, see Catalogue British Museum (Natural History).

— Tabular view of the orders and families of fishes. Compiled by P. H. Gosse. Drawn by C. R. Bone. J. W. Lowry sculpt. London, 1856. 4 pls.

Add. 1856.1

Loyer, Maurice. La premier exposition internationale d'insectes vivants, de poissons d'ornement, et d'oiseaux de volière. Bull. Soc. Acclim. France, Paris, 1914, 61, 98-101.

Add. 1914.1

Lubbock, (Sir) John. Pre-historic times, as illustrated by ancient remains, and the manners and customs of modern savages. New York, 1872.

Add. 1872.1

Fishing implements, p. 32, 523. Fishing methods, p. 73, 523, 527, 539, 545.

Lubbock, Richard [1759-1808] Observations on the fauna of Norfolk, and more particularly on the district of the

Broads. New edition, with additions from unpublished manuscripts of the author, and notes by T. Southwell . . . also a memoir by H. Stevenson . . . and an appendix containing notes on hawking in Norfolk by A. Newton . . . and on the decoys, reptiles, sea fish, lepidoptera, and botany of the county. Norwich, 1879. 8°.

Add. 1879.1

See also Lubbock, R. 1845.1

Lubecker, J. L. Om det rigtigste saltvandsfiskeri i Danmark, nemligsildefiskeriet, etc. Aalb, 1772. 8°.

Add. 1772.1

Lucas, Arthur Henry Shakespere. Victorian sharks. Victorian Naturalist, 1889, 5, 175-179.

Add. 1889.1

Lucas, Frederic Augustus [1852-] Animals recently extinct or threatened with extermination as represented in the collections of the U. S. National Museum. Rept. U. S. Nat. Mus., 1888-89, 609-647. 10 pls.

Add. 1889.1

Refers to the tilefish, p. 647-649. pl.

— Animals of the past. New York, 1901. 41 figs. ills.

Add. 1901.1

— Animals before man in North America. New York, 1902. 287 p. figs. pls. ills.

Add. 1902.1

Chap. IV: The coming of vertebrates and the rise of fishes. p. 85-112. 11 text figs. illust.

Luccock, John. Notes on Rio de Janeiro and the southern parts of Brazil, 1808-1818, London, 1820.

Add. 1820.1

Fishes and fishing, p. 13-19; 23-24; 147-150; 305.

Lübbert, — [Ueber die Grossbritannischen Fischereihäfen] Fischerbote, 1913, 5. Jahrg., 185; 270; 315; 406; 460.

Add. 1913.1

Lübbert, E. [Ueber die Ausübung der ostpreussischen Eisfischerei] Fischerbote, 1913, 5. Jahrg., 326-

Add. 1913.1

Lübbert, W. Weitere Messungen an nordischen Glasaalen. Allgem. Fischerzeitung, 1911, N. F. 26 (36), 214-217.

Add. 1911.1

Luehe, Max. Report on the Trematode parasites from the marine fishes of Ceylon. (In Roy. Soc. London, Report on the pearl oyster fisheries of the Gulf of Manaar, &c. London, 1906, pt. 5. 4°.)

Add. 1906.1

Lütken, Christian Frederik [1827-1901] *Baandfiske og tudsefiske*. Tidskr. Pop. Frem. Naturoid., 1883, 30, 1-41. 9 figs. Add. 1883.1

— *Fortsatte bidrag til kundskab om de arktiske dybhavstudsefiske, særligt slægten Himantolophus*. Dansk. Vid. Selsk. Skrift., Kjøbenhavn, 1886-88, 4, 323-330; 331-334. Add. 1886.1

Complete reference for Lütken, C. F., 1887.2.

Lumholtz, Carl. Unknown Mexico, etc. 2 vols. New York, 1902. Add. 1902.1

Methods of fishing: I, p. 1. 400-407; with traps, spears, arrows, nets, poisons—*polygonum, amole and soke, and palo de la flecha*.

Lund, C. *Unsere Hochseefischerei*. Prometheus, 1913, 24. Jahrg., 273-278. 10 figs. Add. 1913.1

Lund, C. Frederic. *Rön om fiskeplantering uti insjöar*. K. Svensk. Wet. Acad. Handl., 1761, 184. Add. 1761.1

See Lund, Frederic. 1761.1

Lundberg, Rudolf. *Bidrag till kännedomen om strömmingen i Stockholms skärgård*. Bih. Svensk. Vet. Akad. Handl., 1875-76, 3, no. 4, 1-21. Add. 1875.1

— *Eel fishing with so-called "Hom-mor" (a species of fish pot) on the Baltic coast of Sweden and in the Sound*. Rept. U. S. Fish Comm. 1883 (1885), 11, 415-430. Add. 1885.1

Lunel, Godefroy [1814-1891] *L'époque du frai de l'omble-chevalier dans le lac de Genève*. Arch. Sci. Phys. Nat., 1888, 20, 305-307. Add. 1888.1

Lupu, Hélène. *Régénération de l'épithélium intestinal du Cobitis fossilis*. Ann. Sci. Univ. Jassy, 1909, 5, 182-247. Add. 1909.1

— *Recherches histo-physiologiques sur l'intestin du Cobitis fossilis*. Ann. Sci. Univ. Jassy, 1914, 8, 52-116. 2 pls. Add. 1914.1

Lussana, P. *Casi di avvelenamento per ingestione di tonno*. Boll. Soc. Med. Prov. Bergamo, 1894, 5, 60-62. Add. 1894.1

Lvov, Vasili Nikolaevich. *Ueber Bau und Entwicklung der Chorda von Amphioxus*. Mitth. Zool. Stat. Neapel., 1891, 9, 483-502. pl. Add. 1891.1

— *Ueber einige wichtige Punkte in der Entwicklung des Amphioxus*. Biol. Centralbl., 1892, 12, 729-744. Add. 1892.1

Lydekker, Richard [1849-1915] *Notices of new and other vertebrata from the Tertiaries and Secondaries of India*. [Myliobatis]. Rec. Geol. Surv. Ind., 1877, 10, 30-43. Add. 1877.1

— *Teeth of [Eocene] fossil fishes from Rámri Island and the Punjab*. [Diodon, Capitodus]. Rec. Geol. Surv. Ind., 1880, 13, 59-61. Add. 1880.1

— *Note on Siwalik and Narbada fossils*. [Bagarius]. Rec. Geol. Surv. Ind., 1882, 15, 102-107. Add. 1882.1

— *Catalogue of the remains of Siwalik vertebrata contained in the geological department of the Indian Museum, Calcutta*. Pt. II. Aves, reptilia, pisces. Calcutta, 1886. Add. 1886.1

Pisces, p. 19-21.

— *Fish out of water*. Knowl. & Sci. News, 1906, 29, (n. s. 3), 545. Add. 1906.1

— *The flight of flying fishes*. Knowl. & Sci. News, 1906, 29, (n. s. 3), 391. Add. 1906.2

A further discussion of Abel, O., 1905.2

— *Fossil flying-fishes*. Knowl. & Sci. News, 1906, 29, (n. s. 3), 361. Add. 1906.3

Brief review of Abel, O., 1905.2.

— *A male fish-nurse*. Knowl. & Sci. News, 1906, 29, (n. s. 3), 391. Add. 1906.4

Brief review of Gudger, E. W., 1905.1.

— *A new British fish [Coregonus gracilior]*. Knowl. & Sci. News, 1906, 29, (n. s. 3), 410. Add. 1906.5

Lydell, Dwight. *Increasing and insuring the natural food supply of small-mouth black bass fry, and notes on combination of breeding and rearing ponds*. Trans. Amer. Fisheries Soc. 1910 (1911), 133-136. Add. 1911.1

Lyman, Theodore [1833-1897] *Pick-erels*. Rept. Inland Fisheries Massachusetts, 1869, 21. Add. 1869.1

— *On the possible exhaustion of sea fisheries*. 6. Ann. Rept. Comm. Inland Fisheries, Massachusetts, 1872, 17-40. Add. 1872.1

— [Fish culture] *Address of president of the American Fish-cultural Association, 1884*. 19. Ann. Rept. Comm. Inland Fisheries Massachusetts, 1884, (1885), 36-51. Add. 1885.1

M

M. — Salmon trout, Sebago lake. Amer. Turf Register & Sporting Mag., 1832, **3**, no. 10, 526-529. Add. 1832.1

M. — De zeevisscherij op Java. Tijdschr. Vereen. Nederl. Zeewesen, 1905, 4. jaarg. 86-88. Add. 1905.1

Macalister, A. On the gill skeleton of *Selache maxima*. Proc. British Assoc. Adv. Sci., 48. meet., Dublin, 1878 (1879), 600. Add. 1879.1

Macallum, A. B. The anatomy of *Ameiurus*. Proc. Canad. Inst., 1884, **2**, 347-457. Add. 1884.1

— Some ancestral features in the blood plasma of vertebrates. Journ. Biol. Chem., 1909, **7**, xi-xii. Add. 1909.1

Macartney, James. Sur la structure des branchies dans les fœtus des squales. Journ. Phys., Chim., Hist. Nat., 1818, **86**, 157-158. Add. 1818.1

MacCallum, G. A., & MacCallum, W. G. On *Aspidogaster ringens* Linton, and *A. kemostoma*. Zool. Jahrb. (Abth. Syst.), 1913, **34**, 245-256. 4 figs. Add. 1913.1

Parasitic on *Trachinotus carolinus*, pompano.

McClelland, John [1805-1875] Memorandum on Mr. O'Reily's paper [on isinglass] Calcutta Journ. Nat. Hist., 1842, **2**, 454-456. Add. 1842.1

— On East Indian isinglass, its introduction to, and manufacture for, the European market. Calcutta Journ. Nat. Hist. 1843, **3**, 157-188. pl. Add. 1843.1

McCoy, (Sir) Frederick [1823-1899] For biography and list of works, see Geol. Mag., 1899, **6**, 283-287. — Irish Naturalist, 1899, **8**, 197. — Nature, 1899, **60**, 83. — Science, 1899, **9**, 789. — Zoologist, 1899, **3**, 280. — Quart. Journ. Geol. Soc., 1900, **56**, lix-lx. — Roy. Soc. Yearbook, 1900, 196-198. — Victorian Naturalist, 1900, **16**, 19. — Proc. Roy. Soc., 1905, **75**, 43-45.

— On some new Devonian fossils. Ann. Mag. Nat. Hist., 1851, 2. ser. **8**, 481-489. Add. 1851.1

Describes *Steganodictyum*, n. g., orthotype, *S. cornubicum*, n. sp.; and *S. carteri*, n. sp.

— On the recent zoology and palæontology of Victoria. Ann. Mag. Nat. Hist., 1867, 3. ser. **20**, 175-202. Add. 1867.1

Pisces, p. 182-189.

McDonald, Marshall [1835-1895] Report of the commissioner for the fiscal year ending June 30, 1894, including the reports on the divisions of fish-culture, scientific inquiry and fisheries. Rept. U. S. Fish Comm. 1894 (1896), **20**, 1-175. Add. 1896.1

— Report of the commissioner for the fiscal year ending June 30, 1895, including the reports on the divisions of fish-culture, scientific inquiry and fisheries. Rept. U. S. Fish Comm. 1895 (1896), **21**, 1-123. Add. 1896.2

Macdonough, A. R. Sea-trout fishing (In Mayer, A. M. Sport with gun and rod, etc. New York, 1883, 507-540) Add. 1883.1

McDougall, William, & Hose, Charles. See **Hose & McDougall.**

Macgillivray, John [1822-1867] Narrative of the voyage of H. M. S. "Rattlesnake," commanded by the late Captain Owen Stanley, during the years 1846-1850. 2 vols. London, 1852. pls. & figs. Add. 1846.1

Huge sharks, vol. i, p. 58; native fishing with seine and hook, vol. 1, p. 197-198; abundance of remoras, vol. i, p. 238. Fishing with remora, vol. ii, p. 21.

Macgillivray, William. Lives of eminent zoologists from Aristotle to Linnæus inclusive: With introductory remarks on the study of natural history, and occasional observations on the progress of zoology. (No. XVI of Edinburgh Cabinet Library) With Linnæus' portrait. London, 1834. 8°. Add. 1834.1

McGregor, J. Howard. On the development of the skull in *Ceratodus*. Ann. N. Y. Acad., 1900-01, **13**, 447. Add. 1901.1

MacGregor, (Sir) William. British New Guinea: country and people. London, 1897. 100 p. illust. Add. 1897.1

Fishing methods, kite, traps, nets, bow and arrow, narcotics, etc. p. 69-70.

— [Fishing with the kite, at Dobu] (In Ann. Rept. British New Guinea, July 1, 1897 to June 30, 1898, p. 46. 2 pls. Brisbane, 1898) Add. 1898.1

McIndoo, N. E., & Haseman, J. D. See **Haseman & McIndoo**.

McIntosh, William Carmichael [1838-] Observations on the marine zoology of North Uist, Outer Hebrides. Proc. Roy. Soc. Edinburgh, 1865-1866 (1866), **5**, 600-614. 7 figs. Add. 1866.1

Fishes listed, p. 614.

— The marine invertebrates and fishes of St. Andrews. Edinburgh, 1875. 195 p. 9 pl. 28 text-figs. 4°. Add. 1875.1

Fishes, p. 168-186.

— Catalogue of the vertebrates in the museum of the Literary and Antiquarian Society of Perth. Perth, 1881, 157 p. 63 text-figs. Add. 1881.1

— First report of the St. Andrews Marine Laboratory to the Fishery Board Scotland. 3. Ann. Rept. Fishery Board Scotland, 1884. 12 p. pl. Add. 1884.1

— [The ova of fishes]. Nature, 1885, **31**, 534-536; 555-557. Add. 1885.1

— Report of committee for the purpose of continuing the researches on food-fishes and invertebrates at the St. Andrews Marine Laboratory. Rept. British Assoc. Adv. Sci., 1886, 268-270. Add. 1886.1

— The life-history of a marine food-fish. Proc. Roy. Inst., 1889, **12**, 384-403. Add. 1889.1

— The pelagic fauna of St. Andrews bay during the months of 1888. No. 1. 7. Ann. Rept. Fishery Board Scotland, 1889, 259-410. 4 plates. Add. 1889.2

— [Review of J. T. Cunningham on the sole]. Ann. Mag. Nat. Hist., 1890, 6. ser. **6**, 497-509. Add. 1890.1

— The pelagic fauna of the bay of St. Andrews. 11. Ann. Rept. Fishery Board Scotland, 1893, 284-389. Add. 1893.1

— Additional remarks on trawling. I. series. 12. Ann. Rept. Fishery Board Scotland, 1894, 165-195. Add. 1894.1

— On marine fish-hatching and the Dunbar establishment of the Fishery Board for Scotland. Rept. British Assoc. Adv. Sci., 64. meet., 1894, 688. Add. 1894.2

— The St. Andrews Marine Laboratory under the Fishery Board for Scotland. Bull. Soc. Cent. d'Aquic., France, 1895, **7**, 109-131. Add. 1895.1

— Report on the action of turbines on salmonoids, and on certain weirs in Ireland. Ordered by the Irish Inland Fisheries Comm. to be printed for the Agricultural Dept. 1900. Add. 1900.1

— Note on the food of the salmon, and on salmon-investigations. Internat. Fisheries Meeting, Cork, 1902, 1-2. Add. 1902.1

— Notes on the fishes of Japan. No. III. Zoologist, 1907, 441-443. Add. 1907.1

— On the Nile fishes. Nature, 1907, 10-12. 2 figs. Add. 1907.2

— Scientific work in the sea fisheries. Nature, 1907, **76**, 301-303. Add. 1907.3

— Scientific investigations of fisheries. Nature, 1908, **79**, 144-145. Add. 1908.1

— Notes from the Gatty Marine Laboratory, St. Andrews. No. XXXIII. Ann. Nat. Hist., 1912, 8. ser. **9**, 117-130. 2 pls. Add. 1912.1

Spawning of the hake.

Mackay, George Leslie. From far Formosa; the island, its people and missions. [Edited by J. A. MacDonald] Chicago, 1906. 346 p. Add. 1906.1
List of seventeen species of fishes, p. 83-84.

Macks, J. A. The salmon, its natural propagation and protection. Arnheim, 1883. 18 p. ills. fol. Add. 1883.1

Maclaren, Norman. On trematodes and cestodes parasitic in fishes. Rept. Brit. Assoc. Adv. Sci., 72. meet., Belfast, 1902 (1903), 260-262. Add. 1903.1

Macleay, (Sir) William John [1820–1891] For biography and works see Ent. Month. Mag., 1892, **28**, 26. — Proc. Linn. Soc. New South Wales, 1892, **6**, 707–716. — N. S. Wales Linn. Soc. (Macleay Mem. Vol.), 1893, xii–li.

— Description of a new species of *Galaxias* [*G. coxii*] with remarks on the distribution of the genus. Proc. Linn. Soc. New South Wales, 1881, **5**, 45–47. Add. 1881.1

— Contribution to a knowledge of the fishes of New Guinea. New Zealand Journ. Sci. 1882, **1**, 239. Add. 1882.1

This post-dates Macleay, W. 1881.3. New species *Serranus goldiei*, *S. magnificus*, *Genyorogobidens*, *Mesoprion rubens*, *M. parvidens*, *M. goldiei*, *Diagramma papuense*, *Lethrinus aurolineatus*: all are merely named, not described.

— Contributions to a knowledge of the fishes of New Guinea, no. 2. New Zealand Journ. Sci., 1882, **1**, 274. Add. 1882.2

This mere notice with names only of eight new species of fish antedates Macleay, 1883.1

— Description of two fishes taken in or near Port Jackson. New Zealand Journ. Sci., 1882, **1**, 274. Add. 1882.3

This abstract with names only antedates Macleay, 1883.2

— Notes on a collection of fishes from the Burdekin and Mary Rivers. New Zealand Journ. Sci., 1883, **1**, 485. Add. 1883.1

This short note, giving the names only, of 14 new species, antedates Macleay, 1884.1.

— [Note on the first occurrence in the southern hemisphere of *Selache maxima*] Proc. Linn. Soc. New South Wales, 1883–84 (1884), **8**, 464. Add. 1884.1

— [Notes on commensal fishes, and on *Siphonognathus argyrophanes* in S. Australia] Proc. Linn. Soc. New South Wales, 1883–84 (1884), **8**, 533. Add. 1884.2

— Notices of new fishes. Proc. Linn. Soc. New South Wales, 1885, **9**, 170–172. Add. 1885.1

— Note on *Ctenodax wilkinsoni*, Mad. Proc. Linn. Soc. New South Wales, 1886, 2. ser. **1**, 511. Add. 1886.1

— A remarkable fish from Lord Howe Island. Proc. Linn. Soc. New South Wales, 1886, **10**, 718–720. Add. 1886.2

M'Clelland, John. [Note on a collection of fishes from Singapore] Journ. Nat. Hist. Calcutta, 1842, **2**, 299. Add. 1842.1

— On East Indian isinglass, its introduction to, and manufacture for, the European market. Journ. Nat. Hist. Calcutta, 1843, **3**, 157–188. Add. 1843.1

Macloc, J. (compiler) Natural history of all the most remarkable quadrupeds, birds, fishes, serpents, reptiles and insects in the known world. 3rd edition, corrected and improved. London, 1820. xii, 336 p. 400 engravings. Add. 1820.1

Fishes, p. 245–293, figs.
Another edition London, 1813.

MacMunn, Charles Alexander. Guanine in fishes' skins. Nature, 1895, **52**, 55. Add. 1895.1

McMurrich, James Playfair [1859–] The cranial ribs of *Micropterus*. Science, 1884, **3**, 644. Add. 1884.1

— The problem of the vertebrate head in the light of comparative anatomy. Proc. 7. Intern. Zool. Congr., 1912, 167–176. Add. 1912.1

Similar components in spinal and cerebral nerves.

MacPherson, Hugh Alexander [1858–1901] The germon [*Orcynus germon*] in British waters. Zoologist, 1897, 4. ser. **1**, 580. Add. 1897.1

MacVine, John. Sixty-three years' angling: from the mountain streamlet to the mighty Tay. London, 1891. 263 p. 12°. Add. 1891.1

McWilliam, John Alexander. [On a number of facts concerning the reflex inhibition of the eel's heart] Journ. Physiol., 1884–85, **5**, xix–xxiii. Add. 1884.1

— On the structure and rhythm of the heart in fishes, with especial reference to the heart of the eel. Proc. Roy. Soc., 1885, **38**, 108–129. — Journ. Physiol., 1885, **6**, 192–245. Add. 1885.1

Maddocks, Luther. The menhaden fishery of Maine with statistical and historical details, its relations to agriculture and as a direct source of human food. New processes, products and discoveries. Portland, 1878. 46 p. 4 cuts. 8°. Add. 1878.1

Madrid Moreno, José. Investigaciones experimentales sobre la significa-

ción morfológica de las papilas óbotones terminales de la mucosa olfatoria en ciertos peces óseos. *An. R. Soc. Españ. Hist. Nat. Madrid*, 1887, **16**. 12 p. 3 pls. 8°. Add. 1887.1

For abstract, see Madrid Moreno, J., 1887.1

— Sobre las terminaciones nerviosas periféricas en la mucosa olfatoria de las peces. *An. R. Soc. Españ. Hist. Nat. Madrid*, 1888, **17**. 5 p. pl. 8°. Add. 1888.1

Mahalanobis, Subodh Chandra. Histological changes in the muscle-fat of salmon. *Journ. Physiol. London*, 1898, **22**, 346–347. Add. 1898.1

— Investigations on the life-history of the salmon. *Trans. Cardiff Nat. Soc.*, 1899, **30**, 48–50. Add. 1899.1

Maiden, J. H. Fish-poisons of the Australian aborigines. *Agric. Gazette, New South Wales*, 1894, **5**, 470–472. Add. 1894.1

Thirteen species of plants named.

Maillard, Félix. Tableau des poissons observés dans le département de l'Oise. *Mém. Soc. Acad. Archéol. Sci. Arts Dépt. l'Oise, Beauvais*, 1852–1855, **2**, 441. Add. 1852.1

Mair, — Notes on fishes in upper Whanganui river. *Trans. Proc. New Zealand Instit.*, 1879 (1880), **12**, 315–316. Add. 1880.1

Maitland, (Sir) James Ramsay Gibson. The history of Howietoun, containing a full description of the various hatching-houses and ponds, and of experiments which have been undertaken there from 1873 to the present time and also of the fish-cultural work, &c. *Stirling*, 1887. xxiii, 278 p. illust. 8°. Add. 1887.1

Maitland, J. R. G., & Ewart, J. C. See **Ewart & Maitland**.

Makuschok, M. Ueber genetische Beziehung zwischen Schwimmblase und Lungen. *Vorläufige Mittheilung. Anat. Anz.*, Jena, 1913, **44**, 33–35. Add. 1913.1

Malfer, F. La trota (*Salmo lacustris* Lin.). *Neptunia, Venezia*, 1902, **18**, 243–254. Add. 1902.1

Malm, August Wilhelm [1821–1882] For biographical and bibliographical data, see *Svenskt Biographiskt Lexicon*, Stockholm, 1876, n. F. Bd. 7, 8–13.

Malmgren, Anders Johan [1834–1897] For biography and works see *Auk*, 1898, **15**, 214–215. — *Fauna Flora Fenn. Medd.*, Helsingfors, 1898, **23**, 60–63. — *Ibis*, 1898, **4**, 463–464.

Manger de S. Marc, — See **Mauger de S. Marc, —**.

Mangold, Ernst. Die Produktion von Licht (In Winterstein, Hans. *Handbuch der vergleichenden Physiologie*, Bd. III, Hälfte 2, p. 225–392. 92 figs. Jena, 1910) Add. 1910.1

Fishes as light-producing organisms, p. 304–320. 22 figs.

— Gehörssinn und statischen Sinn (In Winterstein, Hans. *Handbuch der vergleichenden Physiologie*, Bd. IV, p. 841–976. 47 figs. Jena, 1912) Add. 1912.1

Reaktionen auf Schallreize bei Fischen, p. 909–916. 3 figs. Die statische Sinnesorgane (Seitenlinie, Labyrinth, Schwimmblase), p. 939–951. 2 figs.

Manley, John Jackson. Pisciculture in England. *Bull. U. S. Fish Comm.* 1884, **4**, 69–74. Add. 1884.1

Mansel-Pleydell, John Clavell. The morphological history of the fishes. [Presidential address 1900] *Proc. Dorset Field Club*, 1900, **21**, xxxviii–lxvi. Add. 1900.1

Manz, Wilhelm. Ueber die wahrscheinlichen Accommodations-Apparat des Fischeauges. (In Ecker, Alexander. *Untersuchungen zur Ichthyologie*. Freiburg, 1857). Add. 1857.1

Marcacci, A. Sur le pouvoir toxique du sang de thon. *Arch. Ital. Biol.*, 1891, **16**, i. Add. 1891.1

— Sulla tossicità del sangue di tonno. *Atti Cong. Gen. Ass. Med. Ital.* 1891, Siena, 1893, **14**, 241. Add. 1893.1

Marais de Beauchamp, Paul. Etudes sur les cestodes des sélaciens. *Archiv. Parasitol.*, Paris, 1905, **9**, 463–539. 22 figs. Also separate, Paris, 1905. 90 p. 22 figs. Add. 1905.1

Marchesetti, Carlo de. La pesca lungo le coste orientale dell' Adriatico. *Trieste*, 1884. 234 p. Add. 1884.1
An earlier edition, 1882.1.

Marck, W. von der [—1900] Ueber einige Wirbelthiere, Kruster und Cephalopoden der Westfälischen Kreide.

Marck, W. v. d.

Zeitschr. Deutsch. Geol., 1858, **10**, 231-271. Add. 1858.1

Marès, H. Action du froid chez les poissons. Acad. Sci. Montpellier, (*proc. verb.*), Paris, 1850, 5. Add. 1850.1

Marin, Georg. Anmerkungen bey der Lachs-Fischerey in den Holländischen Strömen. König. Schwed. Akad. Abhandl., 1774, 49. Add. 1774.1

See note under Kästner, A. G., in Pre-Linn. section.

— Vom Lachsfange bey Ballyshannon in Irland. Neueste Mannichfaltigk., Berlin, 1779, **3**, 542. Add. 1779.1

— Anmärkningar vid Laxfisket Halländska strömmarne. K. Svensk. Wet. Acad. Handl., 1774 (1781), **36**, 47. Add. 1781.1

Marine, David, & Lenhart, C. H. On the occurrence of goitre (active thyroid hyperplasia) in fish. Johns Hopkins Hosp. Bull., 1910, **21**, 95. Add. 1910.1

— Continued observations and experiments on the so-called thyroid carcinoma of brook trout (*Salvelinus fontinalis*) Bull. Dept. Fisheries Pennsylvania, 1911. Add. 1911.1

— Further observations and experiments on the so-called thyroid carcinoma of the brook trout (*Salvelinus fontinalis*) and its relation to endemic goitre. Journ. Exper. Med., 1911, **13**, 455. Add. 1911.2

Marion, Antoine Fortuné [1846-1900] Documents ichthyologiques: Énumération des espèces rares de poissons capturées sur les côtes de Provence. Zool. Anz., 1886, **9**, 375-380. Add. 1886.1

— Notes sur l'anchois. Ann. Mus. Hist. Nat. Marseille (*Zool.*), 1889, **3**, 58-64. Add. 1889.1

— Recherches sur la sardine de la Méditerranée. Ann. Mus. Nat. Hist. Marseille (*Zool.*), 1889, **3**, 69-83. Add. 1889.2

— Remarques relatives au maquereau des côtes méditerranéennes. Ann. Mus. Hist. Nat. Marseille (*Zool.*), 1889, **3**, 83-87. Add. 1889.3

— Travaux de zoologie appliquée à l'industrie des pêches maritimes effec-

tués à la station d'Endoume. Ann. Mus. Hist. Nat. Marseille, 1897. 34 p. Add. 1897.1

Marsden, William. Account of a phenomenon observed upon the island of Sumatra. Phil. Trans. Roy. Soc., 1781, **71**, 383-385. Add. 1781.1

Vast quantities of fishes thrown on shore during a very dry season.

Marsh, Millard Cales. Hemoglobin estimations and blood counts in fishes. Washington Med. Ann. 1902, **1**, 397. Add. 1902.1

— Epithelioma in trout. Washington Med. Ann., 1903, **2**, 59. Add. 1903.1

— Report on a mortality among young trout at the Allentown station of the Pennsylvania Fishery Commission, during the autumn of 1903. Rept. Dept. Fisheries Commonwealth of Pennsylvania, 1903-04 (1905), 102-108. pl. Add. 1905.1

— The effect of some industrial wastes on fishes. (In Parker, H. N., Willis, B., Bolster, R. H., Ashe, W. W., & Marsh, M. C. The Potomac river basin. U. S. Geolog. Surv., Water Supply & Irrigation Papers, Washington, 1907, no. 912, 337-348.) Add. 1907.1

— Thyroid tumors in salmonoids. Trans. Amer. Fisheries Soc. 1910 (1911), 377-392. pl. Add. 1910.1

— The feeding of trout in relation to thyroid tumor. Trans. Amer. Fisheries Soc., 1914, 13-19. Add. 1914.1

Marsh, M. C., & Gaylord, H. R. See Gaylord & Marsh.

Marshall, A. M. The segmental value of the cranial nerves. Journ. Anat. Physiol. London & Cambridge, 1882, **16**, 305-354. pl. — Studies Biol. Labs. Owens Coll., 1886, **1**, 125-169. 2 pls. Add. 1882.1

Martel, Emile. La pêche du hareng à Boulogne-sur-Mer. Le Monde Moderne, 1898, **8**, 342-354. 10 figs. Add. 1898.1

Martens, E. von. Bericht über die Leistungen in der Ichthyologie während des Jahres 1882. Archiv. Naturg. Berlin, 1883, **49**, pt. 2, 555-622. Add. 1883.1

Martin, Anton Rolandson. Natürlicher Phosphorus, oder Versuche mit Fischen und Fleisch, so im Finstern

leuchten. König. Schwed. Akad. Abhandl., 1761, 224. — Abstract in Comment. Lips., 12, 70. Add. 1761.1

See note under Kästner, A. G., in Pre-Linn. section.

—— Naturlig phosphorus, eller rön på fisk och kött, som lyser i mörkret. K. Swensk. Wet. Acad. Handl., 1761, 225. Add. 1761.2

—— Anmerkungen über die so genannten aussätzigen Fische und Vieh in Norwegen. König. Schwed. Akad. Abhandl., 1760 (1762), 22, 301–305. Add. 1762.1

—— De natuurlyke phosphorus, of proefneemingen met visch en vleesch, die in't donker licht geeven. Uitgezogte Verhandel., 1765, 10, 327–334. Add. 1765.1

—— Gordier, Knoten- oder Fadenwürmer, bey Fischen und Menschen gefunden, mit versuchten Mitteln solche zu vertreiben. König. Schwed. Akad. Abhandl., 1771, 258. Add. 1771.1

See Martin, A. R., 1771.1

See also note under Kästner, A. G.

—— Von einem besondern Wurm, der wie eine Spritze aussieht und hydatides oder Wasser-Hülsen in den Eingeweiden des Stinks (Osmerus) verursacht. Neue. König. Schwed. Akad. Abhandl., 1780, 42. Add. 1780.1

See Martin, A. R., 1780.1.

See also note under Kästner, A. G.

Martinet, F. N. (engraver) Histoire naturelle des Dorades de la Chine. Paris, [1780] 32 p. 48 pls. sm. fol. Add. 1780.1

In the copy in the Amer. Mus. Nat. Hist., the 30-page introduction is politico-historical in nature and contains no reference to fishes. Next there are two pages of text descriptive of the 48 plates. These were designed in China, and finely engraved in Paris by one who signs himself "Martinet Fils." The plates in this copy have been colored by hand in magnificent fashion. The names are in both Chinese and French.

Credited by the catalogue of the British Museum (Natural History) to E. L. B. de Sauvigny and so entered in this Bibliography (vol. II, p. 394). However, according to both Engelmann and Sherborn, the editor and describer was Marie Jules César Lelorgne de Sauvigny [Sauvigny]. Further, according to the Catalogue of the British Museum (Natural History), these plates were reproduced in Kaiserlich-Französische Akademische Handlung, Augsburg, 1786, along with certain ones from Willughby's De Historia Piscium, and others from Bloch's Naturalem Historiam Piscium.

See also Sauvigny, M. J. C. L. de. Add. 1780.1

Martini, Friederich Heinrich Wilhelm. Brief von der Entstehung der

Zungenfische. Berlin. Saml., 1768, 1, 249. Add. 1768.1

—— Vorläufige und abgekürzte Nachricht vom Zitteraale. Berlin. Saml., 1769, 2B, 362. Add. 1769.1

—— Anmerkungen über die Fischerey. Berlin. Saml., 1770, 3B, 602; *Ibid.*, 6B, 298. Add. 1770.1

—— Der Brasilianische Seeteufel (i.e. *Lophius histrio*) Abstract in Berlin. Saml., 1773, 6B, 172. Add. 1773.1

—— Kurze Naturgeschichte der Fledermaus oder des Americanischen Seeteufels (i.e. *Lophius vespertilio*). Berlin. Saml., 1773, 6B, 169. Add. 1773.2

—— Kurze Naturgeschichte des Fischerfrosches oder des Africanischen Seeteufels. (i.e. *Lophius piscatorius*). Berlin. Saml., 1773, 6B, 83. pls. Add. 1773.3

—— Bemerkung von der Schädlichkeit einiger Fische (Bourses, perroquets und vieilles). Berlin. Saml., 1774, 7B. Add. 1774.1

—— Vom Schlambeisker (i.e. *Cobitis fossilis*) Berlin. Saml., 1774, 7B. Add. 1774.2

—— Der Tobias fisch (*Ammodytes*) und Pfeilfisch (*Esox belone*). Berlin. Saml., 1775, 8B, pls. Add. 1775.1

—— Von dem Alter der Fische. Berlin. Saml., 1775, 8B. Add. 1775.2

Martius, C. F. P. von. For biography of, see Schramm, Hugo, C. F. P. v. Martius. Sein Lebens- und Charakterbild insbesondere seine Reiseerlebnisse in Brasilien. 2 vols. (in 1). Leipzig, 1869. portr. 8°. Also Rau, Charles. Memoir of C. F. P. von Martius. Rept. Smithsonian Instit., 1869 (1872), 169–178.

—— Wörtersammlung Brasilianischer Sprachen. Leipzig, 1867. Add. 1867.1

Contains native names of many Brazilian fishes, i. e. those found in Marcgrave.

Marukawa, Hisatoshi. Young stages of *Leptocephalus unagii*, n. sp., from Japan [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 3, 5–9. Add. 1914.1

Marwitz, — von. Schreiben über die Versetzung einiger Fischarten. Beschäft. Naturf. Freunde., 1779, 4, 915. Add. 1779.1

Mason, Frank H. Self-reproducing food for young fish. Bull. U. S. Fish Comm. 1887 (1889), 7, 203-206.

Add. 1889.1

Mason, James Wood. On a new acrodont saurian from the Lower Chalk. Quart. Journ. Geol., 1869, 25, 442. pl.

Add. 1869.1

Describes *Acrodontosaurus gardeneri*, n. g. et n. sp., from Lyddons Spout near Folkstone. A synonym of *Pachyrhizodus* according to Woodward.

Mason, Otis Tufton. Aboriginal American harpoons: a study in ethnic distribution and invention. Report Smithsonian Inst. 1900 (1902), 189-304. 19 pls. 92 figs.

Add. 1902.1

Massal, E. *Amblypterus decorus* Egerton, poisson fossile du houiller de Commentry. Naturaliste, 1894, 2. ser. 8, 199-200. fig.

Add. 1894.1

Massas, Charles de. Le pêcheur à la mouche artificielle et le pêcheur à toutes lignes. Third edition, reviewed and corrected. Paris, 1861. 12°.

Add. 1861.1

Other editions are: Paris, 1852, 1859 (2d ed. reviewed and augmented), and [n. d.] 311 p.

"One of the most genuine of French angling books, although its author is manifestly ignorant of all the more subtle mysteries of his craft." — W. & S.

Masso, Angelo. Ein Gift, welches im Blut der Murænen vorkommt. Jahresb. Fortschr. Tier-Chem., Wiesbaden, 1889, 18, 92.

Add. 1889.1

Review by von Vintschgau of Masso, A., 1888.1.

Mast, S. O. Changes in pattern and color in fishes, with special reference to flounders. Science, 1913, n. s. 38, 699.

Add. 1913.1

Masterman, E. W. G. The fisheries of Galilee. Palestine Exploration Fund, Quarterly Statement, Jan. 1908, 48 p.

Add. 1908.1

Oral gestation in *Hemichromis sacra*, a cichlid fish.

— Studies in Galilee. Chicago, 1909.

Add. 1909.1

Oral gestation in Chromidæ, p. 43-44.

Mather, Frederic. For memorial notice see Dean, B. 1900.5.

— Work at Cold Spring harbor, Long Island, during 1883 and 1884. Rept. U. S. Fish Comm. 1884 (1886), 12, 129-142. 2 pls.

Add. 1886.1

— Report on Adirondack fishes. 18. Ann. Rept. Commissioner of Fisheries New York, 1890, 124-176.

Add. 1890.1

— Pickerel, pike, and mascalonge. Forest & Stream, 1898, 50, 410-412.

Add. 1898.1

— Modern fish-culture in salt and fresh water. New York, 1900. 333 p.

Add. 1900.1

Contains important matter on ponds and their management.

Mathieu, A. Cours de zoologie forestière. I. Mammifères, oiseaux, reptiles, poissons. Nancy, 1847. 400 p. pls.

Add. 1847.1

Matson, W. J. Salmon and trout fishing in Ireland; the angler's pocket-book and guide. Dublin, 1910. 199 p. 6 pls. 12°.

Add. 1910.1

Matsuura, Kwanichiro. On the freshwater fishes of Japan. I & II [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 1, 12-13. — *Ibid.*, no. 2, 8-9.

Add. 1914.1

Matte, Paul. Ein lebendig gebärender Aquarienfisch (*Girardinus decemmaculatus*) Beobachtungen und Erfahrungen. Natur u. Haus, 1900, 8, Heft 7.

Add. 1900.1

Matthews, J. Duncan, & Ewart, J. C. See Ewart & Matthews.

Matveev, B. De la mésométrie de la tête des Sélaciens. [Text in Russian] Journ. Sect. Zool. Soc. Nat., Moscow, 1914, 2, 203-244.

Add. 1914.1

Résumé in French, pp. 245-248.

Mauduit, —. Description de quelques espèces de poissons . . . offerts au congrès par M. de la Pylaie. Cong. Scient. France, Poitiers, 1834 (1835), 2. sess., 61.

Add. 1835.1

Mauger de S. Marc, —. Dissertation sur la population & l'âge des poissons, avec un traité sur la pêche. Paris, 1764. 12°.

Add. 1764.1

Boehmer writes this name Manger.

Maurel, — & Lagriffe, —. Détermination et action des plus hautes températures compatibles avec la vie de certains poissons. C. R. Mém. Soc. Biol. Paris, 1899, 11. sér. 1 (51), 797-800.

Add. 1899.1

Maurer, Felix. Von allerlei Merkwürdigkeiten der Fische und der

Wasserthiere (In Grundig, C. G. Neue Versuche Sammlung Natur und Kunstgesch. Obersachsen. 4 vols. Schneeberg, 1750-1765) Add. 1750.1

Maurer's article is in vols. II, p. 311, and IV, p. 825.

Maurer, Friedrich. Die Entwicklung des Darmsystems. (In Hertwig, O. Handbuch Entwicklungslehre der Wirbeltiere. Jena, 1906, vol. ii, pt. 1, p. 109-241. 70 figs.) Add. 1906.1

Treated in comparative fashion, with constant references to fishes.

Mauriac, E. Rapport sur la question des morues rouges; étude d'hygiène alimentaire sur les accidents toxiques occasionnés par la morue avariée et l'interdiction de la mise en vente des morues rouges. Trav. Cons. Hyg. Pub. Gironde, Bordeaux, 1885 (1886), 27, 391-452. — Mém. Bull. Soc. Méd. Chir. Bordeaux, 1886, 159-207. — Journ. Méd. Bordeaux, 1885-6, 15, 425; 437; 459; 461. Add. 1886.1

English translation is as follows:

— Cases of poisoning caused by spoiled codfish, and the unnecessary prohibition of the sale of reddened codfish. Rept. U. S. Fish Comm. 1886 (1889), 14, 1027-1053. Add. 1889.1

Translated by H. Jacobson.

Maximilian I. See **Hohenleiter & Fritz.**

Mayer, Alfred M. (editor) Sport with gun and rod in American woods and waters. New York, 1883. pls. & figs. Add. 1883.1

Fourteen articles on angling, p. 337-614.

Meckel, Johann Friedrich [1781-1833] Ueber die Blendung im Auge des Hochschauers (*Anableps tetraphthalmus*) Deutsch. Arch. Physiol., 1818, 4, 124-125. Add. 1818.1

— Additamenta ad historiam molluscorum, piscium et amphibiorum. Halæ, 1832. vi, 41 p. 4°. Add. 1832.1

Meehan, William E. Fish, fishing and fisheries of Pennsylvania. (Pennsylvania's fish exhibit at the World's Columbian Exposition, Chicago, 1893) Harrisburg, 1893. 106 p. illust. — Rept. State Comm. Fisheries, Pennsylvania, 1892-94 (1895), 257-392. *Ibid.*, 1896 (1897), 313-449. Add. 1893.1

— Fish culture for farmers. Rept. Pennsylvania Dept. Agric. 1895, 115-134. Add. 1895.1

— History of trout culture in Pennsylvania. Rept. State Comm. Fisheries Pennsylvania, 1897, 169-193. Add. 1897.1

— Native fishes and introduced fishes (In his The mountain lakes of the state (Pennsylvania), chapters 2 and 3. Rept. State Comm. Fisheries Pennsylvania, 1897, 251-402) Add. 1897.2

— The history of the sturgeon. Rept. Fish Comm. Fisheries Pennsylvania, 1899. 225-250. Add. 1899.1

— Facts about fish. Rept. Comm. Fisheries State Pennsylvania 1900 (1901), 159-165. Add. 1901.1

— Over-planting and over-protection of fish. Rept. Comm. Fisheries State Pennsylvania 1900 (1901), 131-151. Add. 1901.2

— The common food fishes of Pennsylvania. Rept. Fish Comm. Pennsylvania, 1902, 125-154. Add. 1902.1

— The fish industry of Lake Erie. Rept. Fish Comm. State Pennsylvania, 1902, 101-109. Add. 1902.2

— Trout fry vs. fingerlings for planting. Rept. Dept. Fisheries Commonwealth Pennsylvania 1903-4 (1905), 127-131. Add. 1905.1

— Observations on the small-mouth black bass in Pennsylvania during the season of 1910. Trans. Amer. Fisheries Soc. 1910 (1911), 129-132. Add. 1911.1

— Work of Pennsylvania in stopping water pollution. Trans. Amer. Fisheries Soc. 1910 (1911), 293-298. Add. 1911.2

Meek, A. The growth of flatfish. Sci. Investig. Northumberland Sea Fish. Comm., 1905, 58. Add. 1905.1

Meek, A. S. A naturalist in cannibal land [New Guinea] London, 1913. 238 p. illust. Add. 1913.1

Fishing with the poison root (name not given) p. 83; with the spider's-web net, p. 140-141; with the remora, p. 205.

Meek, Seth Eugene [1859-1914] A note on the Cuban eel. Bull. U. S. Fish Comm., 1884, 4, 111. Add. 1884.1

— The utility of a biological station on the Florida coast in its relation

Meek, S. E.

to the commercial fisheries. Proc. Nat. Fish. Congress. Bull. U. S. Fish. Comm. 1897 (1898), 17, 181-183.

Add. 1898.1

— List of fishes known to occur in the waters of Indiana. Bienn. Rept. Comm. Fisheries & Game Indiana 1907-08 (1908), 134-172. Add. 1908.1

— Estudios de los pescados de Nicaragua. Primera parte. Sinopsis de los peces de los grandes lagos de Nicaragua. Managua, Nicaragua, 1913. 66 p.

Add. 1913.1

Mégnin, Jean Pierre. Sur le développement du *Tricuspidaria nodulosa* ou *Triænoporus nodulosus* de Rudolphi [cestoides des poissons carnassiers d'eau douce] et sur son cysticerque. C. R. Acad. Sci. Paris, 1881, 92, 994-996. — Rec. Méd. Vét., Paris, 1882, 59 (6. ser. 9), 39-41.

Add. 1881.1

Mégnin, P. Épidémie sur les gardons (*Leuciscus idus* Bl.) des pièces d'eaux vives d'une propriété près du Mans. Bull. Mém. Soc. Centr. Méd. Vét., Paris, 1883, n. s. 1, 430-437.

Add. 1883.1

Mehl, H. F., & Kahlenberg, L. See **Kahlenberg & Mehl.**

Meinertz, J. Beiträge zur vergleichenden Morphologie der farblosen Blutzellen. Arch. Path. Anat., 1902, 168, 353-398. 11 pls.

Add. 1902.1

Leuciscus, Perca, Tinca, Carassius, Anguilla, Cyprinus und Petromyzon.

Meissen, K. Fremdländische Zierfische. Einiges über Schützenfische. Blätt. Aquar.-Terrar. Freunde, 1895, 6, 136.

Add. 1895.1

Meissner, Valerian Ivanovich. Die Kaspische Expedition der Jahre 1912-1913. Die Heringsfischerei am Kaukasischen Ufer des Kaspischen Meeres. (Arbeiten der Expedition i. J. 1912) [Text in Russian] Mater. Pozn. Russk. Rybolov., Petrograd, 1914, 3, i-viii + 1-14. 17 pls.

Add. 1914.1

Meredith, (Mrs.) Charles. My home in Tasmania, during a residence of nine years. 2 vols. London, 1852.

Add. 1852.1

Fishes, vol. II, p. 230-232; 240-242.

Meredith, Louisa A. Tasmanian friends and foes, feathered, furred, and finned. 2 ed. London, 1881.

Add. 1881.1

Méricourt, Leroy de, & Fonssagrives, J. B. See **Fonssagrives & Méricourt.**

Mérieux, —, & Carré, — Sur la psorospermie du barbeau. Mém. C. R. Soc. Sci. Méd. Lyon, 1898 (1899), 38, 141-144. 2 figs. — Reviewed in Rec. Méd. Vét., Paris, 1899, 76 (8. ser. 10), 125-127.

Add. 1899.1

Merle, René. Comment avoir un aquarium. La Nature, 1912, 40, pt. 2, 273-276. 4 figs.

Add. 1912.1

— Le transport du poisson d'eau douce vivant. La Nature, 1912, 40, pt. 2, 47-48. 4 figs.

Add. 1912.2

Merriam, C. Hart. The muskrat as a fish eater. Bull. U. S. Fish Comm., 1884, 4, 297-298.

Add. 1884.1

Metcalf, M. M. Salpa and the phylogeny of the eyes of vertebrates. Anat. Anz., 1906, 29, 526-528.

Add. 1906.1

Metzger, A. Süßwasserfischerei. Internat. Fischerei-Ausstell. Berlin, 1880 (1881). Amtliche Berichte iii, 8°.

Add. 1881.1

Metzger, A., Guthe, H., & Zuchold, E. v. (editors). See **Zuchold, Guthe, & Metzger.**

Meunier, Stanislas. Contribution à la géologie [Eocene] du Bas-Sénégal. C. R. Acad. Sci. Paris, 1898, 126, 666-669.

Add. 1898.1

Teeth of Lamna, Galeocerdo, and Odontaspis.

— Roches phosphates du Bas-Sénégal. Bull. Mus. Hist. Nat., Paris, 1898, 4, 112.

Add. 1898.2

Eocene sharks.

— Nouvelle contribution à la géologie du Sénégal. Bull. Soc. Geol. France, 1906, 4. ser., 6, 79.

Add. 1906.1

Eocene sharks.

Meyer, Christian Erich Hermann von, & Plieninger, Wilhelm Heinrich Theodor von. Beiträge zur Paläontologie Württemberg's enthaltend die fossilen Wirbelthierreste aus den Triasgebilden mit besondere Rücksicht auf die Labyrinthodonten des Keupers. Stuttgart, 1844. 132 p. 12 pls. 4°.

Add. 1844.1

Describes Thectodus, n.g., p. 116, a synonym of Acrodus.

Meyer, Juergen Bono [1829-] Aristoteles Thierkunde. Ein Beitrag

zur Geschichte der Zoologie, Physiologie und alten Physiologie. Berlin, 1855. x, 520 p. 8°. Add. 1855.1

Meyer, M. Ergebnisse von Versuchen betreffend den Gehörsinn der Fische. VI. Congrès Internat. Psychol., Genève, 1909, 731-732. Add. 1909.1

Meyer, P. E. Kiemenhöhle und Kiemengerüst bei den Labyrinthfischen. Inaug. Dissert. Bern, 1904. 7 pls. 8°. Add. 1904.1

Miall, L. C. On a new specimen of *Megalichthys [hibberti]* from the Yorkshire coalfield. Quart. Journ. Geol. Soc., 1884, 347-352. 6 figs. Add. 1884.1

Michael, E. Observations on the effect of temperature and wind on the movements of minnows. (In Hankinson, T. L. A biological examination of lake Michigan. A report of the Biological Survey of the state of Michigan. Rept. State Board Geol. Survey, 1907, 155-258. pls. 13-75.) Add. 1907.1

Michael, M. Luther. Cause of the disappearance of black bass in the Delaware river. Rept. Dept. Fisheries Commonwealth Pennsylvania 1903-04 (1905), 131-135. Add. 1905.1

Michaelis, Albert. The artificial culture and hatching of pike. Trans. Amer. Fisheries Soc. 1910 (1911), 429-432. Add. 1910.1

Translation of article in Fischerei-Zeitung, Neudamm, 1909.

Michaelis, K. Fischzucht. Fischpässe. Internat. Fischerei-Ausstell. Berlin, 1880 (1881). Amtliche Berichte 1. 8°. Add. 1881.1

Michelotti, Jean. Description de quelques nouveaux fossiles du terrain miocène de la colline de Turin. Rev. Magaz. Zool., 1861, 2. ser. 13, 353-355. Add. 1861.1

Describes *Scarus miocenicus* from Turin and *Phyllodus incertus*, from Eocene of Turin Prov., Gassino.

Micoletzky, H. Zur Kenntniss des Faistenauer Hintersees bei Salzburg, mit besonderer Berücksichtigung faunistischer und fischereilicher Verhältnisse. Internat. Rev. Gesamt. Hydrobiol. Hydrog., 1911, 3, 506-542. Add. 1911.1

In der faunistischen Tabelle werden unter Pisces genannt: *Perca fluviatilis* L., *Cottus gobio* L., *Phoxinus phoxinus* L., *Salvelinus salvelinus*

L., *Trutta fario* L. Magen- und Darminhalt wurde untersucht bei allen Formen ausser *Cottus*.

Mienkiewicz, Rommald. Recherches sur la formation des habitudes, le sens des couleurs et la mémoire chez les poissons. Ann. Inst. Océanogr. 1912, 5, fasc. 4, 53. Add. 1912.1

Miescher, Friedrich. Das Protamin eine neue organische Base aus den Samenfäden des Rheinlachs. Ber. Deutsch. Chem. Ges., Berlin, 1874, 7, 376-379. Add. 1874.1

— Histochemische und Physiologische Arbeiten. 2 vols. Leipzig, 1897. Add. 1897.1

Deals largely with metabolism and tissue changes in breeding Rhine salmon. See Miescher-Reusch, 1879.1, et als.

Mihalkowics, V. von. Die chorda des *Amphioxus lanceolatus*. Arch. Mikr. Anat., 1876, 11, 425-441. pl. Add. 1876.1

Miles, Alfred H. (editor) [1848-] Natural history of the world, with anecdotes illustrating the nature, habits, manners and customs of animals, birds, fishes, reptiles, insects, etc., etc. Arranged and edited by Alfred H. Miles. New York, 1895. 393 p. 20 illus. 12°. Add. 1895.1

Miles, George William. The beginning of some state fish hatcheries. Bienn. Rept. Comm. Fisheries & Game Indiana 1911-12 (1913), 40-45. Add. 1913.1

Miles, Preston H. Our black bass. Bienn. Rept. Comm. Fisheries & Game Indiana 1911-12 (1913), 29-39. Add. 1913.1

Miller, Hugh [1802-1856] For a review of his work as a naturalist, see Traquair, R. H. 1903.1.

Millet, É. Accidents d'intoxication par la morue altérée observés au 112° de ligne, à Ajaccio. Arch. Méd. Pharm. Mil., Paris, 1886, 8, 417-447. Add. 1886.1

Milner, James Wood. Summary of fishing records for shad and alewives kept at Willow Branch fishery, North Carolina, from 1835 to 1874. Bull. U. S. Fish Comm. 1881 (1882), 1, 396-400. Add. 1882.1

Minot, Charles Sedgwick [1852-1914] A bibliography of vertebrate embryol-

Minot, C. S.

ogy. Mem. Boston Soc. Nat. Hist., 1886-1893 (1893), 4, 487-614.

Add. 1893.1

— Gegen das gonotom. Anat. Anz., 1894, 9, 210-213. Add. 1894.1

Mitchell, C. Ainsworth. Poisonous plants used for catching fish. Knowl. & Sci. News, 1906, 29 (n. s. 3), 387.

Add. 1906.1

Brief review of Greshoff, M., Add. 1913.1

— The toxine of eel's blood. Knowl. & Sci. News. 1906, 29, (n. s. 3) 359.

Add. 1906.2

— Trachinus venom. Knowl. & Sci. News, 1906, 29 (n. s. 3), 459.

Add. 1906.3

Review of Briot, 1903.2.

Mitchell, C. A., & Wright, C. R. Alder. See **Wright & Mitchell.**

Mitchell, P. Chalmers. The childhood of animals. New York, 1912.

Add. 1912.1

Considerable data on fishes.

Mitchell, T. L. Three expeditions into the interior of eastern Australia. 2 vols. London, 1837.

Add. 1837.1

Vol. i, p. 44, descriptions and figures of *Gristes peelii* and *Plotosus tandanus*; p. 95, description and figure of *Cernua bidyana*.

Vol. ii, p. 24. Poisoning fishes with Eucalyptus.

Miura, M., & Takesaki, K. Zur Localisation des Tetrodon-Giftes. Arch. Path. Anat., Berlin, 1890, 122, 92-99.

Add. 1890.1

Miyamoto, Kunimo, & Tanaka, Shigeho. See **Tanaka & Miyamoto.**

Mocquard, — Sur un nouveau genre de Blenniidae voisin à Clinus (*Acanthoclinus*) Bull. Soc. Philomath. Paris, 1886, 7. ser. 10, 18-20.

Add. 1886.1

Acanthoclinus chaperi, n. g., n. sp.

Mocquard, F. Sur les ovaires de la baudroie (*Lophius*) Bull. Soc. Philomath. Paris, 1888. 8. ser. 1, 46-49.

Add. 1888.1

Möbius, Karl August [1825-1908] Das Aquarium des Zoologischen Gartens zu Hamburg, . . . beschrieben von . . . K. Möbius. Zool. Ges., Hamburg, 1864. 8°.

Add. 1864.1

Third edition, Hamburg, 1865. 8°. Fourth edition, Hamburg, 1866. 8°

— (Various papers on fishes and fisheries of the German seas) (In Meyer, H. A., Möbius, K., Karsten, G., & Hensen, V. Gemeinfässliche Mittheilungen aus den Untersuchungen der Kommission zur wissenschaftlichen Untersuchung der deutschen Meere. Herausgegeben im Auftrage des Königlichen Ministeriums für Landwirthschaft, Domänen und Forsten. Kiel, 1880.)

Add. 1880.1

i. Wissenschaftliche Untersuchungen der Fische nützen der Fischerei. p. 18-20.

ii. Einiges über den Bau des Herings. p. 20-26. 11 figs.

iii. Ueber die Unterschiede des Meeresherings und des Küstenherings. p. 26-27. fig.

iv. Die verschiedenen Altersformen des Herings. p. 28-31. 2 figs.

v. Was veranlasst die Heringe zu wandern und Scharen zu bilden? p. 31-35. fig.

vi. Vergleichung des Herings und des Sprotts. p. 35-38. 2 figs.

vii. Die Larvenform der Plattfische. p. 38. fig.

viii. Einiges über die Nahrung der Fische. p. 39.

— On the movements of the flying-fish through the air. Nature, 1889, 39, 479.

Add. 1889.1

Mochaloff, M. I., & Vasilyeff, S. M. See **Vasilyeff & Mochaloff.**

Moenkhaus, W. J. [1871-] Some stages in hybrid [fish] development. Science, 1900, n. s. 11, 788.

Add. 1900.1

Moerenhout, J. A. Voyages aux îles du grand océan contenant des documents nouveaux sur la géographie physique et politique, la langue, les usages et les coutumes de leurs habitants, etc. 2 vols. Paris, 1837. illust.

Add. 1837.1

Fishing with poison, hooks, the mast, nets, harpoons, etc., i, p. 102-108.

Mohr, Nicolai. Um atferd Nordmanna, Faereyinga, Skotta og Hialtlendinga at veida sma-upsa edr upsa-seidi. Rit Bezs Islenzka Laerdoms-lista Felags. 1782, 3, 193.

Add. 1782.1

Molberg, Christian Gran. Afhandling om saltvands-fiskerierne i Norge. Danske Landhuush. Selsk. Skrift, 1790, 3, 345-386.

Add. 1790.1

Moles, Giov. Von der Fischerey in Dalmatien. Giornale d'Italia, Venezia, 1776, 12, 57.

Add. 1776.1

Molin, Raffaele. Sopra due specie di pesci pubblicate come nuove dal Prof. R. Molin, &c. Venezia, 1853. 16 p. 8°.

Add. 1853.1

Mollier, S. Zur Entwicklung der Selachier-extremitäten. Vorläufige Mittheilung. Anat. Anz., 1892, 7, 351-365. Add. 1892.1

— Die erste Anlage des Herzens bei den Wirbeltieren. (In Hertwig, O. Handbuch Entwicklungslehre der Wirbeltiere, Jena, 1906, vol. i, pt. 1.) Add. 1906.1

Fishes, p. 1030-1035, 9 figs.

— Die erste Entwicklung von Blut und Gefäßen bei Holoblastiern. (In Hertwig, O. Handbuch Entwicklungslehre der Wirbeltiere, Jena, 1906, vol. i, pt. 1.) Add. 1906.2

Dipneusti and Cyclostomes, p. 1077-1089. 18 figs.

Mollier, S., & Rückert, J. See Rückert & Mollier.

Monaghan, T., & Johnstone, James. See Johnstone & Monaghan.

Monteiro de Noronha, José. Roteiro da viagem da cidade do Para até as ultimas colonias dos dominios portuguezes em os rios Amazonas e Negro. Jornal da Coimbra, 1820. — Acad. Sci. Collecção de Noticias Para a Hist. e Geog. das Nações Ultramarinas, 1841-56, 34-35. Add. 1841.1

Written in 1768.

Oral gestation is affirmed for *Gymnotus electricus*, *Arapaima gigas*, and other fishes (presumably Cichlidæ).

See also Du Bois-Reymond, 1882.2, p. 78; Spix & Martius, 1823.1, vol. 3, p. 1090.

Monticelli, Francesco Saverio. Sui parassiti del *Regalecus glesne*. Mon. Zool. Ital. Firenze, 1900, 11 (supp.), 36-37. — Centralb. Bakteriolog. Parasitenk., Jena, 1902, 31 (Abth. 1), Referate, 48. — Arch. Naturg., Berlin, 1904, 63. Jahrg., 2, 21. Add. 1900.1

Moore, J. Percy. The utility and methods of mackerel propagation. Bull. U. S. Fish Comm. 1897 (1898), 17, 353-361. Add. 1898.1

Moore, Thomas J. Report on a successful attempt to introduce living soles into America. Bull. U. S. Fish Comm. 1887 (1889), 7, 1-7. Add. 1889.1

Morande de Thevenau, C. E. Observations sur des poissons recueillis dans un voyage à la baie de Samana. St. Lucia, 1788. Add. 1788.1

Moreau, Emile. Le scopèle de Vérany, *Scopelus verany*. Bull. Soc.

Philomath. Paris, 1887-1888 (1888), 7, ser. 12, 108-111. Add. 1888.1

Morris, Beverley R. Description of an intestinal worm from the duodenum of the white fish of the Canadian lakes. Canad. Journ., Toronto, 1859, n. s. 4 (24), 442-443. fig. Add. 1859.1

Morrow, C. H. Seven cases of acute poisoning caused by eating the liver (and heart?) of a sword-fish. Journ. Boston Soc. Med. Sci., 1896, 135, 197. Add. 1896.1

Morrow, R. On the bones of *Lophius piscatorius*, anglerfish, devilfish, goosefish, etc. Proc. Trans. Nova Scotian Instit. Sci., 1882, 5, 340-357. Add. 1882.1

Mortensen, F. V. Fiskeri-Beretning for Aaret, 1909, heri fiskeristatistik for Faeroerne. Kjøbenhavn, 1910. 246 p. tables. 8°. Add. 1910.1

— Fiskeri-Beretning for Aaret 1911. Kjøbenhavn, 1912. 4°. Add. 1912.1

Morton, A., & Johnston, R. M. See Johnston & Morton.

Morvan, A. De l'empoisonnement par le sourdon (*Cardium edule*) et par la bonite (*Scomber pelamys*). Journ. Chim. Méd., Paris, 1857, 4. sér. 3, 719-729. Add. 1857.1

Moseley, Henry Nottidge [1844-1891] Notes by a naturalist on the "Challenger" . . . various observations made during the voyage . . . round the world in the years 1872-1876. London, 1876. pls. & figs. Add. 1876.1

Contains numerous observations on fishes — see his index.

Later edition, London, 1892.

— A carnivorous plant preying on vertebrata. Nature, 1884, May 22. — Bull. U. S. Fish Comm. 1884, 4, 259-260. Add. 1884.1

Utricularia trapping larval fishes.

Mosher, A. A., Perry, W. A., & others. See Perry, Mosher & others.

Mosso, Angelo. [1846-] Die giftige Wirkung des Serums der Myränen. Arch. Exper. Pathol. Pharm., Leipzig, 1888-89, 25, 111-135. Add. 1888.1

Mouchon, — (On fish poisoning) Journ. Med. Prat. Bordeaux, 1840, 2, ser. 12, 152. Add. 1840.1

Mouchy, A. La production du froid artificiel et son utilisation pour la conservation du poisson. Bull. Trim. Enseign. Pêches Marit., Paris, 1911, 16, 30-74. Add. 1911.1

Moule, Thomas [1784-1851] Heraldry of fish, with notices of the principal families bearing fish in their arms. London, 1842. 250 p. figs. 8°. Add. 1842.1

Müllegger, S. Ringelbrasse und Schmetterlingfische im Seewasseraquarium und an ihnen beobachtete Lähmungserscheinungen. Blätt. Aquar.-Terrar. Kunde, 1906, 17. Jahrg., 263-266; 276-278; 284-286. pl. & 2 figs. Add. 1906.1

Müller, Gerard Frederic [1705-1783] Mémoire sur la colle de poisson. Mém. Math. Phys. Scavans et Etrang. Acad. Sci. Paris, 1768, 5, 263-269. Add. 1768.1

Müller, Johannes [1801-1858] Bericht über die Fortschritte der vergleichenden Anatomie im Jahre 1835. Arch. Anat. Physiol., 1836, l-lxxxix. Add. 1836.1

Very valuable résumé of fish papers.

— Vergleichende Anatomie im Jahresberichte im Jahre 1836. Arch. Anat. Physiol., 1837. Add. 1837.1
Sharks and rays. p. lxxvii-lxx.

— Bericht über die Fortschritte der vergleichenden Anatomie der Wirbelthiere [1837-1843]. Arch. Anat. Physiol., 1838-44. Add. 1838.1

Numerous reviews of articles on fishes.

— Ueber eine eigentümliche Krankhafte parasitische Bildung mit specifisch organisirten Samenkörperchen. Arch. Anat. Physiol. (Müller), 1841, 477-496. pl. — Micros. Journ., 1842, 2, 123-4. — Brit. & For. Med. Review, Jan. 1842. Add. 1841.1

Psorosperms parasitic on fishes.

— Untersuchung über den Scyllit. Ber. Deutsch. Chem. Ges., 1907, 40. Jahrg., 1821-1826. Add. 1907.1

— Die Choroidaldrüse bei den Knochenfischen. Sitzber. Ges. Naturf. Freunde Berlin, [for] 1839-1859, 1912, 18-19. Add. 1912.1

This is a reprint, issued in 1912, of the reports of the meetings for the years 1839-1859.

Müller, J. & Retzius, A. Ueber parasitische Bildungen. Arch. Anat., Physiol., 1842, 193-198. Add. 1842.1

Müller, O. Ueber Brutpflege bei Amphibien und Fischen. 60.-66. Jahresber. Nat. Ges., Hannover, 1912. — 2.-4. Jahresber. Niedersächs. Zool. Ver., 1912, iii-iv. Add. 1912.1

Müller, Otto Friedrich. Vom Bandwurm des Stichlings und vom milchigten Plattwurm. Naturforscher, Halle, 1782, 18, 21-37. 11 figs. Add. 1782.1

Müller, Philip Ludwig Statius. Des Ritters Carl von Linné königlich schwedischen Leibartes . . . vollständigen Natursystems Supplements- und Register-Band über aller sechs Theile oder Classen des Thierreichs mit einer ausführlichen Erklärung ausgefertigt von Philipp Ludwig Statius Müller. Nürnberg, 1776. 3 pls. Add. 1776.1

For note on the fishes described in this work, see Jordan, D. S., 1891.3

Müller, Wilhelm. Beobachtungen des pathologischen Instituts zu Jena, erster Reihe. Jena. Zeitschr. Naturw., 1871, 6, 327-453. Add. 1871.1

i. Ueber den Bau der Chorda dorsalis, p. 327-353.

ii. Ueber Entwicklung und Bau der Hypophysis und des Processus infundibuli cerebri. 354-425. 3 pls.

iii. Ueber die Entwicklung der Schilddrüse. 428-453. 3 pls.

Münster, Georg (Graf zu) [1776-1844] [Fossil fishes] (In Braun, C. F. W. Verzeichniss der in der Kreis-Naturalien-Sammlung zu Beyreuth befindlichen Petrefacten. Leipzig, 1840. vii, 118 p. 22 pls. map.) Add. 1840.1

Saurorhynchus, p. 73; not defined; orthotype *Saurichthys tenuirostris* (Münster).

— Beschreibung und Abbildung der in den Kalkmergelschichten von St. Cassian gefunden Versteinerungen (In Wissmann, H. L., & Münster, G. Beiträge zur Geognosie und Petrefacten-kunde des südöstlichen Tirols. Beiträge zur Petrefacten-Kunde, 1841, 4. Heft, 1-152. 16 pls.) Add. 1841.1

Fishes, p. 140-141. *Gyrolepis biplicatus*, *Tetragonolepis obscurus*, *Asterodon bronnii* [n. g. et n. sp.], *Hybodus hexagonus* & *H. angulatus*. 5 figs.

— Beitrag zur Kenntniss einiger neuen seltenen Versteinerungen aus den lithographischen Schiefern in Baiern. Neues Jahrb. Mineral., 1842, 35-46. Add. 1842.1

Describes Aethalion, p. 42; logotype *A. inflatus*, and Libys, p. 45; orthotype *L. polypterus*.

— Beschreibung einiger merkwürdigen Fische aus den Kupferschiefern

von Richelsdorf und Eisleben. Beiträge zur Petrefacten-Kunde, 1842, 5. Heft. Add. 1842.2

i. *Dorypterus hoffmanni*. See Germar, E. F. Add. 1842.1.

ii. Bemerkungen zu den Gattungen Janassa und Dictya. 37-39. 7 figs.

iii. Zur Gattung Acrolepis [*A. exsculptus*]. 40-42.

iv. Zur Gattung Platysomus [*P. althausii*]. 43-45. fig.

v. *Platysomus fuldai* Münster. 45-47. fig.

vi. Genus Globulodus, eine neue Gattung Pycnodonten. 47-48. fig.

vii. Bemerkungen zum *Pygopterus humboldti* Agassiz. 48-49. fig.

viii. Zur Gattung Coelacanthus, Agassiz. 49-50.

— Ueber eine neue Art Myriacanthus im Jurakalk. Beiträge zur Petrefacten-Kunde, 5. Heft, 111. fig. Add. 1842.3

M. vesiculosus, from Lindener Berges, near Hannover.

— Beschreibung einiger seltenen Versteinerungen des Zechsteins [*Janassa angulata*]. Beiträge zur Petrefacten-Kunde, 2nd ed., 1843, 1. Heft, 65-67. Add. 1843.1

Heft 1, 1st edition, 1839; 2nd ed., 1843.

— Ueber einige merkwürdige Fische [Janassa, Saurichthys, & Placodus] aus dem Kupferschiefer und dem Muschelkalk. Beiträge zur Petrefacten-Kunde, 2nd ed., 1843, 1. Heft, 121-127. Add. 1843.2

Mulder, E. A. Saagmanns. See Saagmanns Mulder, E. A., in vol. I.

Mulier, Wm. Vischkweekerij en instandhouding van den vischstand. Haarlem, 1900. xx, 492 p. pl. 8°. Add. 1900.1

Mullenix, R. C. The peripheral terminations of the eighth cranial nerve in vertebrates, especially in fishes. Bull. Mus. Comp. Zool. Harv. Coll., 1909, 53, no. 4. Add. 1909.1

Muller, J. W. Fishing around New York. New York, 1909. 64 p. 12°. Add. 1909.1

Mulsow, K. & Plehn, Marianne. See Plehn & Mulsow.

Mundini, C. De anguillæ ovariis. Comm. Inst. Bonon., 1783, 6, 406-418. Add. 1783.1

Munier, — Sur la maladie occasionnée par differens poissons de l'Ile de France et de Bourbon, connus par les colons sous le nom de bourses, de perro-

quets, et de vieilles. Obs. Phys. Hist. Nat. (Rozier), 1774, 3, 229-233.

Add. 1774.1

Muratet, L., & Sabrazès, Jean. See Sabrazès & Muratet.

Murchison, (Sir) Roderick Impey, [1830-1879] For life of, see Geikie, (Sir) A. Life of Sir R. I. Murchison, etc. London, 1875.

— Siluria. The history of the oldest known rocks containing organic remains, etc. London, 1854. xv, 523 p. 37 pls. text ill. 8°. Add. 1854.1

This work is mainly a condensation of the author's "Silurian System" with additions to include late discoveries.

— Siluria. The history of the oldest fossiliferous rocks and their foundations, etc. London, 1859. 592 p. 42 pls. 8°. Add. 1859.1

Fossil fish are illustrated on plates 36 and 37.

— Siluria: a history of the oldest rocks in the British isles and other countries, etc. 4th (and last) edition. London, 1867. 566 p. ill. map. 8°. Add. 1867.1

Murchison, R. I., & Sedgwick, Adam. See Sedgwick & Murchison.

Murchison, (Sir) R. I., Verneuil, E. de, & Keyserling (Count) A. de The geology of Russia in Europe and the Ural mountains. Géologie de la Russie d'Europe et des montagnes de l'Oural. 2 vols. London & Paris, 1845. 69 pls. text ill. 4°. Add. 1845.1

Vol. I is in English; Vol. II in French.

See also Agassiz, L., Add. 1845.1, and Owen, R., Add. 1845.1.

Murie, J. & Harvie-Brown, J. A. Loch Broom sea monster. Zoologist, 1906, 10, 396-398. Add. 1906.1

Selache maxima.

Murphy, Robert Cushman, & Nichols, John Treadwell. See Nichols & Murphy.

Murray, David. Museums — their history and their use — with a bibliography and list of Museums in the United Kingdom. 3 vols. Glasgow, 1904. 8°. Add. 1904.1

Murray, J. [Herring making sounds] Mag. Nat. Hist., 1831, 148.

Add. 1831.1

— Fishes possess an audible voice. Mag. Nat. Hist., 1833, 6, 527.

Add. 1833.1

Murray, J. H. P. Papua or British New Guinea. London, 1912. 388 p. 38 pls. Add. 1912.1

Fishing with the kite, p. 117-118; with tuba, a poisonous plant, p. 118.

Musschenbroek, P. van. Jacht en visscherij (In Catalogus der afdeeling Nederlandsche Kolonien van de Internationale Tentoonstelling (1883) te Amsterdam. Leiden, 1883.) Add. 1883.1

Musseleck, G. Die Regenbogenforelle (*Salmo irideus*). Einführung aus

Amerika, Aufzucht, Verbreitung und Bewahrung in Deutschland, etc. Köln, 1902. 116 p. Add. 1902.1

Musset, —, Brix, — & Ehrenberg, —. See **Brix, Musset, & Ehrenberg.**

Musy, M. La vessie natatoire des poissons, son rôle, son fonctionnement. Bull. Soc. Sci. Nat. Fribourg, 1912, 20, 56-58. Add. 1912.1

Rôle hydrostatique.

Muto, K., & Hayashi, H. See **Hayashi & Muto.**

N

Naegele, A. Fischarten und Fischschutz in der oberen Donau vor 400 Jahren. *Allgem. Fischerei-Zeitg.*, 1913, 38. Jahrg., 604-605. Add. 1913.1

Nagel, Wilibald, A. Vergleichend physiologische und anatomische Untersuchungen über den Geruchs- und Geschmackssinn und ihre Organe mit einleitenden Betrachtungen aus der allgemeinen vergleichenden Sinnesphysiologie. *Bibl. Zool.*, 1894, 18. Hft., 1-107. 7 pls. Add. 1894.1
Fishes, p. 183-192.

Nall, John Greaves. Great Yarmouth and Lowestoft, chapters on the . . . natural history, etc. of the district, with statistics of the East Coast herring fishery, etc. London, 1867. 728 p. 4 maps. 8°. Add. 1867.1

Nanz, Fr. Beiträge zum Bezuge von Regenbogenforellen-Eiern aus Amerika. *Fischerei Zeitg.* Neudamm, 1911, 14, 833-836. Add. 1911.1

Nardo, G. D. [1802-1877] Proposizione per la formazioni di un nuovo generi di pesci, intitolato Brachyochirus. *Ann. Sci. Reale Lomb. Venet.*, Padova, 1844, 13, 6-8. Add. 1844.1

— Sopra due specie di pesci pubblicate come nuove dal prof. R. Molin. *Osservazioni.* Venezia, 1853. 16 p. 8°. Add. 1853.1

Title from catalogue of the British Museum (Natural History). Bosgoed, and Carus & Engleman say 1854.

Nash, C. W. Fishes (In Check-list of the vertebrates of Ontario and catalogue of specimens in the biological section of the provincial museum, p. 451-452. Department of Education, Toronto, 1908.) Add. 1908.1

— Fishes. (In Faull, J. H. *Natural history of the Toronto region.* Toronto, 1913, 249-271.) Add. 1913.1

Nash, D. W. On progressive development in the cold-blooded vertebrata. *Journ. Asiatic Soc. Bengal*, 1833, 2, 465-474. Add. 1833.1
Fishes considered.

Naville, — Lettres sur les abus de la pêche dans le lac de Genève. *Mém. Soc. Oecon. Berne*, 1762, pt. 3, 25. Add. 1762.1

Translated into German as follows:

— Schreiben über die Nothwendigkeit, durch eine bessere Policy der Erschöpfung des Fisch-Fanges im Genfer-See vorzubeugen. *Abhandl. Oekon. Gesell. Bern*, 1762, pt. 3, 29. Add. 1762.2

Neal, Herbert Vincent. The morphology of the eye-muscle nerves. *Journ. Morphol.*, 1914, 25, 1-187. 9 pls. 4 text figs. Add. 1914.1
Squalus acanthias embryos used.

Neale, J. J. Pisces of the Bristol Channel (In James, Ivor (editor) *Handbook for Cardiff and district*, prepared for the use of the British Association. Cardiff, 1891. v. 244 p. illust. 8°.) Add. 1891.1

Neill, J. Catalogue of reptiles and fish found at King George's Sound. (In Eyre, E. J. *Journals of expeditions of discovery into Central Australia, &c.* 2 vols. London, 1845. 1, appendix. 8°.) Add. 1845.1

Nelli, B. Il Miocene del monte Titano nella repubblica di San Marino. *Rendic. Accad. Lincei*, Roma, 1906, 5. ser. 15, 2. sem., 741-744. Add. 1906.1

Occurrence of *Oxyrhina*, *Odontaspis*, *Galeocerdo*, *Carcharodon*, *Sargus* and *Sphærodus*.

Nengermann, A. A., Nierstrass, H. F., & Kerbert, C. See **Nierstrass, Nengermann & Kerbert.**

Neuhauss, R. *Deutsch Neu-Guinea.* 3 vols. Berlin, 1911. illust. Add. 1911.1

Fishing, vol. iii, p. 293-297, with hooks, nets, baskets, weirs, poison, spider's web lure, etc.

Neumann, Carl W. How man acquired his five fingers. A hand is but a promoted fin. *Scient. Amer. Suppl.*, 1910, 69, 44. 2 figs. Add. 1910.1
Translated from Reclam's "Universum."

Neumann, R. O. Studien ueber protozoische Parasiten im Blute von Meeresfischen. Zeitschr. Hygiene Infektionskr., 1909, **14**, 1-112. 6 pls.
Add. 1909.1

Nevin, James. Reminiscences of forty-one years' work in fish-culture. Trans. Amer. Fisheries Soc. 1910 (1911), 313-318.
Add. 1911.1

Newberry, John Strong [1822-1892]. For biography and bibliography, see White, Charles A. "Biographical memoir of John Strong Newberry, 1822-1892." Nat. Acad. Sci., Biographical Memoirs, 1902, 1-22.

— The fauna and flora of the Trias of New Jersey and the Connecticut valley. Trans. N. Y. Acad. Sci., 1886-87 (1887), 1-5.
Add. 1886.1

Newman, Edward [1801-1876] Some account of an enormous undescribed fish, apparently one of the Raiidæ, killed by the crew of H.M.S. "Frolic" off the coast of California. Zoologist, 1849, **7**, 2357-2358.
Add. 1849.1

Describes *Brachioptilon hamiltoni* n. g. and n. sp.; synonym of *Manta*.
To replace Newbold, T. J., 1849.1; an error.

— Aerating aquariums. Zoologist, 1875, 2. ser. **10**, 4383-4384.
Add. 1875.1

— The maigre [*Sciæna aquila*] off Yarmouth. Zoologist, 1875, 2. ser. **10**, 4725-4726.
Add. 1875.2

— Vaagmaer, or deal-fish, in Ireland. Zoologist, 1875, 2. ser. **10**, 4343-4344.
Add. 1875.3

Newton, E. T. [1840-] Typical parts in the skeleton of a cat, duck and codfish. Being a catalogue with comparative descriptions arranged in a tabular form. London, 1875. 21 p. pl. 8°.
Add. 1875.1

Erroneously entered under date 1895.1.

— The chimæroid fishes of the Sussex Chalk. (In Dixon, F. The Geology of Sussex . . . New [Second] edition, etc., Brighton, 1878. 4°.)
Add. 1878.1

— List of fishes from the English Chalk. (In Dixon, F. The geology of Sussex, etc. Brighton, 1878. 4°.)
Add. 1878.2

— On fishes' tails. Journ. Quekett Micr. Club, 1882-84, **1**, 79-97. pl.
Add. 1882.1

— [The fossil fishes of the Grays Thurrock area] (In Hinton, M. A., & Kennard, A. S. Contributions to the Pleistocene geology of the Thames valley. 1. The Grays Thurrock area. Essex Naturalist, 1900, **11**, 336-370.)
Add. 1900.1

Nicolai, Joh. Aug. Heinr. Untersuchungen über den Verlauf und die Vertheilung der Venen bei einigen Vögeln, Amphibien und Fischen, besonders die Venen der Nieren betreffend. Isis, 1826, 404-416. Abstract in Bull. Nat. Sci. (Férussac), 1827, **10**, 278-280.
Add. 1826.1

Nicolas, —. Notice sur le petit poisson vulgairement connu à Caen sous le nom de montée. Trav. Labor. Caen, 1816, 11.
Add. 1816.1

Nicoll, William. A contribution towards a knowledge of the entozoa of British marine fishes. Part I. Ann. Mag. Nat. Hist., 1907, 7. ser., **19**, 66-94. 4 pls. — Reviewed in Journ. Roy. Micr. Soc., London, 1907, 170.
Add. 1907.1

Nicolson, (Père) —. Essai sur l'histoire naturelle de St. Domingue. Paris, 1776.
Add. 1776.1

Description and figure of batfish, p. 347-348.

Nierstrass, H. F., Nengermann, A. A. & Kerbert, C. Gezeichnete Rheinlachse. Fischerei Zeitg. Neudamm, 1911, **14**, 699-700. Add. 1911.1

Nieuwenhuis, A. W. In centrall-Borneo. 2 vols. Leiden, 1900. illust.
Add. 1900.1

Fishing with "tuba," etc. i, 204-215; ii, 47, 106-107.

— Quer durch Borneo; Ergebnisse seiner Reisen in den Jahren 1894, 1896-1897, und 1898-1900. 2 vols. Leiden, 1904-07. illust. Add. 1904.1

Fishing implements, nets, spears, hooks, poisons (tuba), etc., vol. i, p. 186-195.

For frequent references to fishes and fishing methods, etc., see his detailed index.

Nilsson, Sven [1787-1883] For biographical notice and list of works, see Stock, Geol. För. Förh., 1884-85, **7**, 143-144.

Ninni, Emilio. Il "Rizzagio" (Giacchio). Neptunia, Venezia, 1903, **18**, 207-210.
Add. 1903.1

Various fishes referred to.

Nishikawa, T. On the development of *Engraulis japonicus* Houtt.

Journ. Fisheries Bureau, Tokyo, 1901, 10, 1-12. pl. Add. 1901.1

Nitsche, P., & Weltner, W. Ueber einen neuen Hautparasiten (*Tetramitus nitschei*) an Goldfischen. Centralb. Bakteriolog. Parasitenk. Jena, 1894, 16, 25-30. 4 figs. Add. 1894.1

Noel, E. Treatise on management of freshwater fishes with a view to making them a source of profit to landed proprietors. London, 1841. 44 p. Add. 1841.1

Noetling, Fritz. Fauna of the Miocene beds of Burma. Palæont. Indica, 1901, n. s. 1, pt. 3, 1-378. 25 pls. Add. 1901.1

Pisces, pp. 372-377, pl. 25.
Oxyrhina pagoda, n. sp., p. 372.

Nordenskiöld, Adolf Erik. The arctic voyages of Adolf Erik Nordenskiöld 1858-1879. London, 1879. xiv, 447 p. illust. 8°. Add. 1879.1

Shark fishing, p. 132-133. Other scattered references to fishes.

Nordqvist, Harald. Papers listed as Nordqvist, O. F., 1908.2; 1911.1;

1912.1; 1913.1, and 1914.1, should properly be referred to this author.

Nordqvist, Oscar. For biography see Schneider, O. 1905.1

— An American fish in Finland. Bull. U. S. Fish Comm. 1894. 14, 27-28. Add. 1894.1

See also Nordqvist, O. F., 1893.4

Norny, E. R. Artificial propagation of rockfish and eels. Bull. U. S. Fish Comm. 1885, 5, 315. Add. 1885.1

Norris, Thaddeus. The Michigan grayling (In Mayer, A. M. Sport with gun and rod. New York, 1883, 493-538. figs.) Add. 1883.1

Probably identical with Norris, T., 1879.1, and with Anon., no. 284, iii.

Northrup, A. Judd. Fishes and fishing in the Adirondacks. 8. & 9. Ann. Repts. Forests, Fish & Game Comm., N. Y., 1902-03 (1903), 275-294. pls. Add. 1903.1

Nye (junior), Willard. Do snakes catch and eat fish? Bull. U. S. Fish Comm. 1883, 3, 196. Add. 1883.1

O

O'Connor, D. Fish acclimatization in Queensland. Proc. Roy. Soc. Queensland, 1897, **12**, 108-110.

Add. 1897.1

Oellacher, Joseph. Beiträge zur Geschichte des Keimbläschens im Wirbelthiereie. Arch. Mikr. Anat., 1872, **8**, 1-27. pl.

Add. 1872.1

Eggs of *Trutta fario* used.

Oertel, Anton. Gregarinose bei Fischen. Zeitschr. Nahrungsmit. Untersuch. Hyg., Wien, 1895, **9**, 4-5. — Zeitschr. Fleisch-Milch-hyg., Berlin, 1895, **5**, 116.

Add. 1895.1

Ogilby, J. Douglas. Catalogue of the fishes of New South Wales, with their principal synonyms. Rept. Comm. Fisheries, New South Wales, 1886. append. II A., 1887. 4.

Add. 1887.1

— Description of a little-known Australian fish of the genus *Girella* [*G. cyanea*] Proc. Zool. Soc. London, 1887, 393-395.

Add. 1887.2

— On a new genus of Percidæ [*Chthamallopteryx*] Proc. Zool. Soc. London, 1887, 616.

Add. 1887.3

— On an undescribed fish of the genus *Prionurus* [*P. maculatus*] from Australia. Proc. Zool. Soc. London, 1887, 395.

Add. 1887.4

— Description of a new genus and species of deep-sea fish [*Sternoptichides amabilis*] Proc. Linn. Soc. New South Wales, 1888, 2. ser. **3**, pt. 2, 1313.

Add. 1888.1

— [Exhibition of and remarks on *Anthias cichlops*] Proc. Linn. Soc. New South Wales, 1888, 2. ser. **3**, pt. 1, 740.

Add. 1888.2

— [Exhibition of larval forms of *Trachypterus*] Proc. Linn. Soc. New South Wales, 1888, 2. ser. **3**, pt. 3, 1258.

Add. 1888.3

— [Exhibition of specimens and photographs of rare fishes] Proc. Linn.

Soc. New South Wales, 1888, 2. ser. **3**, pt. 2, 1096.

Add. 1888.4

— Note on the cause of death of fishes in the National Park dam. Proc. Linn. Soc. New South Wales, 1888, 2. ser. **3**, pt. 1, 890-891.

Add. 1888.5

— [*Apogon guentheri* an oral incubator] Proc. Linn. Soc. New South Wales, 1889, 2. ser., **3**, 1554.

Add. 1889.1

First record of oral gestation in Cheilodipterids.

— The reptiles and fishes of Lord Howe Island. Mem. Austral. Mus., 1889, **2**, 52-74. 2 pls.

Add. 1889.2

— Digest of report on a collection of reptiles, batrachians, and fishes forwarded from St. Joseph river by Sir William MacGregor, administrator of British New Guinea. Ann. Rept. British New Guinea, 1889-1890 (1890), append. W, p. 116.

Add. 1890.1

— Report on a zoological collection from British New Guinea. I, Reptiles, batrachians and fishes. Rec. Austral. Mus., 1890 (1891), **1**, 89.

Add. 1891.1

— Edible fishes and crustaceans of New South Wales. Sydney, 1893. 212 p. 50 pls.

Add. 1893.1

Published for distribution at World's Columbian Exposition, Chicago, 1893.

— [Note on two genera of rough-backed herrings, *Potamolosa* (n. g.) and *Hyperlophus* Ogilby, distinct from *Diplomystus*]. Proc. Linn. Soc. New South Wales, 1896, 2. ser. **11** (21), 504-505.

Add. 1896.1

See also Woodward, A. S. 1892.2.

— Pisces (In his Contributions to a knowledge of the fauna of British New Guinea. Proc. Linn. Soc. New South Wales, 1898, 2. ser. **13** (23), 363)

Add. 1898.1

Records seven species of freshwater fishes.

Ogilby, J. D., & Ramsay, E. P. See **Ramsay & Ogilby.**

- Ogneff, J. F.** General sketch of our knowledge of the structure of electric organs [Text in Russian] Russ. Arch. Patol. Klin. Med. Bakteriolog., St. Petersburg, 1896, 2, 283-300. Add. 1896.1
- Okada, S.** Catalogue of vertebrated animals of Japan. Tokyo, 1891. 145 p. Add. 1891.1
Classification in Latin; species in Latin and Japanese.
- Okuda, Y.** Quantitative determination of creatine, creatinine and mono-amino-acids in certain fishes, mollusca and crustacea. Journ. Coll. Agric. Univ. Tokyo, 1912, 5, 25-31. Add. 1912.1
- Olaffen, or Olafssyn or Olavsen, Olaf.** Von Entstehung der Schollen. (Solea). Berlin. Samml., 1768, 1, 249. Add. 1768.1
- De piscatura ope retium in Islandia promouenda, Islandice tit. Um Fiski-veidar, etc. Copenhagen, 1771, 8°. Add. 1771.1
- Nomina Islandica herbarum, piscium et avium cum additis nominibus Linnæanis. [Text in Islandic] Rit Pesz Islenszka Laerdoms-Lista Felags, 1780, 1, 1-19. Add. 1780.1
- Um lagvad. Rit Pesz Islenszka Laerdoms-Lista Felags., 1780 (1781), 1, 76-86. pl. Add. 1781.1
Float with attached hooks for catching sharks.
- Um lúrna-verkun a Jótlanzskaga. Rit Pesz Islenszka Laerdoms-Lista Felags., 1781 (1782), 2, 168-172. Add. 1782.1
Pleuronectes.
- Lítilfiörligt ágríp um ála-veidar. Rit Pesz Islenszka Laerdoms-Lista Felags., 1782 (1783), 3, 205-214. Add. 1783.1
Muræna anguilla.
- Oldendorps, —** Geschichte der Mission auf den caraibischen Inseln. Barby, 1777. Add. 1777.1
Poisoning by eating fish, p. 111.
- Oliver, S. Pasfield.** The life of Philibert Commerson, D.M., naturaliste du roi. London, 1909. 242 p. illust. Add. 1909.1
Various references to fishes. Remora same color above and below, p. 99 (earliest explanation) Fishing with the remora, p. 171.
- Olivier, L., & Richet, Ch.** Les microbes de la lympe des poissons marins. Journ. Microg., 1883, 7, 432-434. Add. 1883.1
- Olsen, O. T.** International regulations of the fisheries of the high seas. Proc. 4. Internat. Fishery Congr. Washington, 1908. Bull. Bur. Fisheries 1908 (1910), 28, part 1, 77-82. Add. 1910.1
- Olsson, Peter.** Iakttagelser öfver skandinaviska fiskars föda, &c. Acta Karolinska Univ. Lund, 1871-72, 8, pt. iii. 12 p. Add. 1872.1
- On Sarcotaces och Acrobothrium, två nya parasitsläkten från fiskar. Ofvers Vetensk. Akad. Förh., Stockholm, 1872, 29, 37-44. 8 figs. Add. 1872.2
- Oltmanns, Korschelt, Linck & others (Editors).** See **Korschelt, Linck, Oltmanns & others.**
- Onodi, A. D.** Neurologische Untersuchungen an Selachiern. 1. Das Ganglion ciliare. 2. Die Vagusgruppe. Math. Naturwiss. Ber. Ungarn, 1887, 5, 179-188. Add. 1887.1
See also Onodi, A. D., 1901.1.
- Oppel, Albert.** Mundhöhle, Bauchspeicheldrüse und Leber. (In his Lehrbuch vergleichenden mikroskopischen Anatomie Wirbelthiere. Jena, 1900, pt. 3.) Add. 1900.1
Fishes, p. 6-17; 129-132; 509-511; 784-787; 820-836; 1025-1037.
- Atmungsapparat (In his Lehrbuch vergleichenden mikroskopischen Anatomie Wirbeltiere. Jena, 1905, pt. 6.) Add. 1905.1
Kiemenatmung, p. 8-164. 77 figs. Lungenatmung, Dipnoi, p. 229-235. 3 figs.
- Atmungsapparat [Jahresbericht] Anat. Hefte, 1905 (1906), 15, Abth. 2, 289-331. Add. 1906.1
- Schwimmblase. Ergebnisse Anat. Entwickl., 1906, 16, 30. Add. 1906.2
- Die Fischerei. Geogr. Zeitschr., 1913, 19, Heft 3, 136-153. *Ibid.*, Heft 4, 202-214. Add. 1913.1
Economic importance of the world's fisheries.
- Leitfaden für die embryologischen Prakticum und Grundriss der Entwicklungslehre der Menschen und der Wirbeltiere. Jena, 1914. 484 ills. Add. 1914.1

Ordway, J. P. Smelts. 9. Ann. Rept. Comm. Inland Fisheries, Massachusetts, 1875, 36-38. Add. 1875.1

O'Reilly, E. [Comments on] Official papers on isinglass received from the government. Calcutta Journ. Nat. Hist., 1842, 2, 450-454. Add. 1842.1

Orton, Edward. [Cephalaspis in the Old Red Sandstone of New York.] Scientific Amer., 1861. Add. 1861.1

Orvis, Charles F. & Cheney, A. Nelson [editors] Fishing with the fly. Troy [N. Y.] 1885. 325 p. pls. Add. 1885.1

Osawa, K. On poisoning by Tetrodon. [Text in Japanese] Iji Shinbun, Tokio, 1884, no. 122, 3-9. Add. 1884.1

Osborne, Jonathan. On Aristotle's History of Animals. Ann. Nat. Hist., 1840, 5, 358-360. Add. 1840.1

Osburn, Raymond Carroll [1872-] Review of Holder, C. F., & Jordan, D. S., Fish Stories. Science, 1910, n. s. 32, 379-380. Add. 1910.1

— Federal control of migratory fish. Bull. N. Y. Zool. Soc., 1914, 17, 1087. Add. 1914.1

— Fish cancer investigation. Bull. N. Y. Zool. Soc., 1914, 17, 1088-1089. Add. 1914.2

— The half-moon fish [*Pterophylum scalare*] Bull. N. Y. Zool. Soc., 1914, 17, 1085-1086. fig. Add. 1914.3

— The increased utilization of carp. Bull. N. Y. Zool. Soc., 1914, 17, 1094-1096. Add. 1914.4

— A new species of angel-fish. Bull. N. Y. Zool. Soc., 1914, 17, 1168. Add. 1914.5

Reference to *Angelichthys townsendi*, Nichols & Mowbray. (1914.1)

— Remarkable recovery of a wounded fish. Bull. N. Y. Zool. Soc., 1914, 17, 1086-1087. Add. 1914.6

— The scale as an index to the age of a fish, and the age of the Pacific salmon. Bull. N. Y. Zool. Soc., 1914, 17, 1084-1085. fig. Add. 1914.7

Otterstrøm, C. V. Fisk II. Blødfinnfisk (Danmarks fauna 15) The Danish Malacopterygii. Kiøbenhavn, 1914. 354 p. 150 figs. Add. 1914.1

Otto, Adolphus William, D'Alton, Edward, & Carus, Carl Gustav. See **Carus, Otto, & D'Alton.**

(**Otto, C.**) Onomatologia forestalis-piscatorio-venatoria oder vollständiges Forst-, Fisch- und Jagd-Lexikon, in welchem alle bey den Forst-, Fisch- und Jagdwesen vorkommenden Kunstwörter erklärt, der Vorhalt die Kenntniss, die Holzungen, die Natur und Eigenschaften der wilden Thiere, die Vögel und die Federwildprets, auch die Raub-, Strom- und Teichfische beschrieben. 4 vols. Leipzig & Stuttgart, 1772-80. Add. 1772.1

Overton, Charles P. Pioneers in the Pacific codfish industry. Pacific Fisherman Annual, 1906, 70-75. Add. 1906.1

Owen, (Sir) Richard (editor). [1810-1890] Descriptive and illustrated catalogue of the physiological series of comparative anatomy contained in the museum of the Royal College of Surgeons of London. 5 vols. London, 1833-40. 4°. Add. 1833.1

— On the structure of teeth, and the resemblance of ivory to bone, as illustrated by microscopical examinations of the teeth of man, and of various existing and extinct animals. Rept. Brit. Assoc. Adv. Sci. 8. meet., 1838 (1839), 7, 135-150. Add. 1839.1

Teeth of fishes, 137-144: *Myliobates*, *Acrodus nobelis*, *Psammodus latissimes*, *Chimæra*, *Lamna*, *Carcharias megalodon*, *Dictyodus*, *Lepidotus*, *Gyrodus*, *Barbel*, *Holoptychus*.

— Report on British fossil reptiles. Rept. Brit. Assoc. Adv. Sci., 11. meet., 1841 (1842), 60-204. Add. 1841.1

Describes *Raphiosaurus*, new genus p. 145, orthotype *R. subulidens* (p. 190, name only), here considered a lizard. A synonym of *Pachyrhizodus* according to Woodward.

— Description of the remains of a bird, tortoise, and lizard from the Chalk of Kent. Trans. Geol. Soc., London, 1842, 2. ser. 6, 411-413. pl. Add. 1842.1

Further describes and figures *Raphiosaurus*.

— An account of the microscopic structure of certain fossil teeth from the environs of Riga, by which they are determined to belong to the genus *Dendrodus* of Sauroid fishes. — Prof. Owen upon certain Saurians of the Permian rocks. (In Murchison, R. I., & others. The geology of Russia i

Europe, &c. London & Paris, 1845, 1, append. B & C. 4°) Add. 1845.1

—— Notice of a batrachoid fossil in British coal shale. Quart. Journ. Geol. Soc., 1853, 9, 67–70. pl. Add. 1853.1

Describes *Parabatrachus colei*, n. g. et n. sp., supposedly an amphibian; a synonym of *Megalichthys*.

—— Principes d'ostéologie comparée, ou recherches sur l'archétype et les

homologies du squelette vertébré, &c. Paris, 1855. 440 p. 3 tabs. 15 pls. 8°. Add. 1855.1

—— Description of the fossil reptilia of South Africa in the collection of the British Museum. London, 1876, 1. 88 p. Add. 1876.1

Records *Hypterus bainii*, p. ix, new genus, from Beaufort beds. A name only without description; a synonym of *Atherstonia* according to Woodward.

P

Pacinotti, G. Osservazioni sperimentali intorno ad una epizoozia di pesci dorati (*Cyprinus auratus*); nota di patologia comparata. Gazz. Osp., Milano, 1893, **14**, 971-973.

Add. 1893.1

Packard, Wales H. On resistance to lack of oxygen and a method of increasing this resistance. Amer. Journ. Physiol., 1905-06 (1905), **15**, 30-41.

Add. 1905.1

Experiments on *Fundulus*, *Ctenolabrus*, and Stickleback.

Page, W. F. Les méthodes les plus récentes pour l'incubation des oeufs des poissons au moyen des appareils MacDonald. Bull. Soc. Cent. d'Ag. Pêche, 1898. 16 p. 8°. Add. 1898.1

Pagnoni, G. Avvelenamento per ingestione di tonno. Boll. Soc. Med. Prov. Bergamo, 1894, **5**, 62.

Add. 1894.1.

Palmer, — [Exhibition of and remarks on young *Ceratodus forsteri*] Proc. Linn. Soc. New South Wales, 1906, **31**, 60.

Add. 1906.1

Palmer, Edward. Notes on some Australian tribes. Journ. Anthropol. Inst. Great Britain & Ireland, 1884, **13**, 276-334.

Add. 1884.1

Plants [5] used to poison fish, p. 322.

Palmisano, A. G. I nostri pescatori in Algeria. Neptunia, Venezia, 1904, **19**, 90-93.

Add. 1904.1

Pancritius, L. Karpfenverdauung. Mitteil. Fischerei Ver. Prov. Ostpreuss., Königsberg, 1885, **2**, 18; *ibid.*, **4**, 33, 43.

Add. 1885.1

Paneth, J. Ueber das Epithel des Mitteldarmes von *Cobitis fossilis*. Centralb. Physiol., 1889, **2**, 485-486; 631.

Add. 1889.1

Papillon, J. Les poissons d'eau douce. Deux tableaux en folio avec les noms en 9 langues, les caractères, habitudes, nourriture de chaque espèce. Troyes, 1894. 8°. Add. 1894.1

Parker, G. H. The skin, lateral-line organs and ear as organs of equilibrium. Science, 1905, n. s., **21**, 265.

Add. 1905.1

Parker, G. H., & Stabler, E. M. On certain distinctions between taste and smell. Amer. Journ. Physiol., 1913, **32**, 230-240.

Add. 1913.1

Parker, T. J. On a specimen of the great ribbon fish (*Regalecus argenteus*, n. sp.) recently obtained at Moeraki, Otago. New Zealand Journ. Sci., 1883, **1**, 520.

Add. 1883.1

This description antedates the similar paper, Parker, T. J., 1884.2.

— Notes on embryos of *Callorhynchus*. Nature, 1883-84 (1884), **19**, 46.

Add. 1884.1

Parker, T. Jeffery & Parker, W. N. An elementary course of practical Zoology. London, 1900. Add. 1900.1

The dog-fish, p. 413-465. 19 figs.

Parker, W. N. On the poison gland of *Trachinus*. Anat. Anz., 1888, **3**, 468-470; 873.

Add. 1888.1

Parkinson, J. Outlines of oryctology; an introduction to the study of fossil organic remains; especially of those found in the British strata. London, 1822. 346 p. illust. 8°.

Add. 1822.1

3. ed. London, c. 1835. 350 p. illust. Fishes, p. 277-283.

Parkinson, R. Im Bismarck-Archipel. Erlebnisse und Beobachtungen auf der Insel Neu-Pommern (Neu-Britannien) Leipzig, 1887. 154 p. illust.

Add. 1887.1

Fishing with nets and traps, p. 113-115.

— Zur ethnographie der nordwestlichen Salomon Inseln. Abhandl. Ber. K. Zool. Anthropol.-Ethnogr. Mus. Dresden, 1899, **7**, 35 p.

Add. 1899.1

Fishing with nets, hooks, kite, spears, etc., p. 34-35.

— Dreissig Jahre in der Südsee: Land und Leute. Sitte und Gebräuche im Bismarck-Archipel und auf den deutschen Salomon-Inseln. Stuttgart,

1907. 876 p. 56 pls., 4 charts. 141 text-figs. Add. 1907.1

Fishing with spears, hooks, traps, kites, poisoned fishes; noosing sharks; catching bonito, Ruvettus, etc. See his good index.

Parona, Corrado, & Perugia, Alberto. Nuove osservazioni sull' *Amphibdella torpedinis* Chatin. Ann. Mus. Civ. Storia Nat. Genova, 1889-90 (1890), 2. ser., 9 (29), 363-367. fig. Review in Centralb. Bakteriolog. Parasitenk., Jena, 1890, 8, 335-336. Add. 1890.1

— Trematodi parassiti delle branchii dei pesci italiani. Atti Soc. Ligust. Sci. Nat. Geog., Genova, 1890, 1, 59-70. Review in Centralb. Bakteriolog. Parasitenk., Jena, 1890, 8, 310. Add. 1890.2

— Sopra due nuove specie di trematodi ectoparassiti di pesci marini (*Phylline monticelli* e *Placunalla vallei*). Atti Soc. Ligust. Sci. Nat. Geog., Genova, 1895, 6, 84-87. 2 figs. — Boll. Mus. Zool. Genova, 1895, 4 p. 2 figs. Abstract in Zool. Centralb. Leipzig, 1895, 2, 341. Add. 1895.1

— Sopra due nuove specie di trematodi parassiti delle branchii del *Brama rayi*. Atti Soc. Ligust. Sci. Nat. Geog., Genova, 1896, 7, 135-138. 4 figs. — Boll. Mus. Zool., Genova, 1896, 4 p. 4 figs. Abstract in Zool. Centralb., Leipzig, 1896, 3, 653. Add. 1896.1

Partiot, L. Mémoire sur les Cyclostomes. Toulouse, 1848. 71 p. 8°. Add. 1848.1

Pascoe, Francis P. The flying-fish. Nature, 1880-81 (1881), 23, 312. Add. 1881.1

— The thresher (*Alopias vulpes*). Nature, 1880-81 (1881), 23, 35. Add. 1881.2

Patarol, Lorenzo. Estratto di lettera 8 luglio 1724 a Giandomenico Bertoli su la raccolta dei pesci del Bolca fatta da Giambatista dalla Valle farmacista di Vicenza. (In Iscrizione Veneziane raccolte ed illustrate da E. A. Cicogna. Venezia, 1842, vol. v, p. 119.) Add. 1842.1

Patterson, Arthur H. Notes of an east coast naturalist. 2. ed. London, 1904. 12 pls. 8°. Add. 1904.1
Fishes, p. 191-253.

— Nature in eastern Norfolk. 2. ed. London, 1906. 12 pls. 8°. Add. 1906.1

Patterson, William. An account of a new electrical fish (*Malapterurus*). Phil. Trans. Roy. Soc. London, 1786, 76, 382-383. fig. Lichtenberg's Mag., 1787, 4, pt. 4, 48-49. — Journ. de Phys., 1787, 30, 196-197. — Mag. Neuste Phys. Naturgesch., 1787, 4, 4. St., 48-49. *Ibid.*, 1789, 6, 2. St., 78-80. Add. 1786.1

Patton, M. J. Whitefish of the Great Lakes. Rept. Comm. Conservation Canada, 1912, 13-24. Add. 1912.1

Paul, Victor. Ichthyophthiriasis in einer besonders hartnäckigen Form. Wochenschr. Aquar.-Terrar. Kunde. 1914, 11. Jahrg., 196-198, 538-540. 9 figs. Add. 1914.1

Pauwels, W. M. I. Borst. Bijdrage tot de kennis der Surinaamsche visch-vergiften [*Nekoe*] Inaug. Dissert. Leiden, 1903. 87 p. 12. Add. 1903.1

Pavesi, Pietro [1844-1907] Materiali per una fauna del cantone Ticino. Atti Soc., Ital. Milan, 1873, 16. 33 p. 8°. Add. 1873.1

Pavlenko, M. N. Wissenschaftlich-gewerbliche Erforschung der Gewässer des Fernen Ostens. Beiträge zur Kenntnis von *Clupea harengus* L. [Text in Russian] Mat. Pozn. Russk. Rybolov., Petrograd, 1914, 3, 1-189. 12 pls. Add. 1914.1

Pearson, Joseph. Ceylon pearl oyster fisheries. Ceylon Admin. Repts. pt. iv, Education, Science, & Art. — Mar. Biol., 1912-1913 (1913), 1-35. Add. 1913.1

Fishes taken, p. 2-5: contents of fishes' stomachs, p. 5-16.

Peck, Thomas. Parental attachment of the miller's thumb (*Cottus gobio*). Student & Intell. Observ., 1869, 3, 455-458. Add. 1869.1

Pellegrin, Jacques (1873-) Bibliography of, published by Masson et Cie., 1910. 104 p.

— Les grandes squales de nos côtes. Bull. Soc. Cent. d'Acquicult. et Pêche, 1901, 13, 149-155. Add. 1901.1

— Fishes that hatch their eggs in their mouths. Scient. Amer. Suppl., 1907, no. 1660. Add. 1907.1

— Poissons curieux du marché de Paris, La Nature, 1912, 40, pt. 2, 115-116. 3 figs. Add. 1912.1

Pellegrin, J.

— Les vertébrés des eaux douces du Maroc. C. R. Assoc. Française Avanc. Sci., 1912 (1913), 41. ser. 419–424. Add. 1913.1

Fishes, p. 422–424.

Pel'tzam, Emmanuil Danilovich [1837–] Account of artificial fertilisation of ganoids and the rearing of the fry of the sterlet [Text in Russian] Sitzber. Naturf. Ges. Kasan, 1874–75 (1876), appendix no. 9. 4 p. 8°. Add. 1876.1

— Biologische Uebersicht über die Kaspischen Heringe [From the Volga Expedition, 1885] Naturf. Ges. Kasan, 1886, 15, no. 5. 8°. Add. 1886.1

Pengelly, W. Tunny on the Somersetshire coast. Zoologist, 1875, 2. ser. 10, 4725. Add. 1875.1

Pennant, Thomas [1726–1798] Beschreibung des *Labri zeylan.* Neueste Mannichfalt., 1778, 1. Jahrg., 620. Add. 1778.1

— Beschreibung des *Squalus vatus.* Neueste Mannichfalt., 1778, 1. Jahrg., 620. Add. 1778.2

Penny, Alfred. Ten years in Melanesia. London, 1887. 232 p. Add. 1887.1

Fishing with the kite, p. 77; with a decoy, p. 77; with the net, p. 119; kinds of fish, pp. 119–121.

Pérard, J. La pêche en Norvège. Rev. Scient. 1899, 4. ser. 11, 673–681. Add. 1899.1

— Comment l'on prépare et l'on assure la conservation de la sardine. Bull. Trim. Enseign. Pêches Maritimes, 1913, 18, 252–273. 6 pls. 2 text-figs. Add. 1913.1

Perce, H. Wheeler. Some general remarks on fishing for sport. Trans. Amer. Fisheries Soc. 1910 (1911), 397–404. Add. 1911.1

Perepelkin, K. Structure of the skeleton of the body and tail of the river lamprey (*Petromyzon fluviatilis*) [Text in Russian] Proc. Imp. Univ. Moscow, 1882, pt. III. 56 p. pl. 8°. Add. 1882.1

Pernety, Antoine Joseph [1716–1801] Histoire d'un voyage aux isles Malouines, fait en 1763 et 1764, etc. 2 vols. London, 1770. Add. 1770.1

Pelagic fishes, I. p. 80–95; 101–103; II, 73–80. Fishes of Santa Catharina, I. p. 168–174;

Isle Lobas, p. 273–289; Fishes of the Malouines, II, p. 33–37.

Also published in Berlin, 1769. 8°.

See also Pernety, A. J., 1771.1; 1773.1

Pernice, B., & Pollaci, G. Sull'azione di taluni microorganismi nei pesci. Riform. Med., Napoli, 1892, 8, pt. 3, 662–673. — Atti Cong. Federaz. Soc. Ital. Ig., 1892, Palermo, 1893, 95–101. Add. 1892.1

Perreau, J. H., & Jouenne, Lucien. See **Jouenne & Perreau.**

Perrier, Léon. Dossiers piscicoles des cours d'eau Alpains. Monographie hydrobiologique piscicole du bassin de la Romanche. Ann. Univ. Grenoble, 1914, 26, p. 191–233. 3 figs. Add. 1914.1

Perrott, Charlotte L. E. Fish of the Avon [Abstract] (In Hastings, (Sir) C., Illustrations of the natural history of Worcestershire, &c. London & Worcester, 1834, append. B. 8°.) Add. 1834.1

Perry, George. Arcana: or the museum of natural history: containing the most recent discovered objects . . . with . . . plates, and . . . descriptions; with extracts relating to animals, and remarks of celebrated travellers, etc. London, 1810–1811. 84 col. pls. Add. 1810.1

Issued in parts, 1810–11. 84 col. pls. with descriptive letterpress.

Congiopus: orthotype *C. percatus*, replaces Agriopus Cuv. 1829.

Perry, W. A. ("Sallicum"), Mosher A. A., & others. American game fishes; their habits, habitat, and peculiarities; how, when, and where to angle for them. Chicago & New York, 1892. 580 p. illus. 8°. Add. 1892.1

Perugia, Alberto, & Parona, Corrado. See **Parona & Perugia.**

Pesson-Maisonnette, —, & Paulin, —. Nouveau manuel complet de pêcheur, ou traité général de toutes les pêches d'eau douce et de mer . . . Nouvelle édition . . . entièrement refondue, par G. Paulin. Paris, 1864. iv, 448 p. pls. 12°. Add. 1864.1

Forms part of the "Encyclopédie Roret," and "Manuels-Roret." There were editions in 1826, 1834, and [1836?].

Peters, Wilhelm. [Ueber zwei fossile Wirbelthiere, . . . *Hemitrichas schisticola*, aus den Tertiärbildungen von Ponte bei Laverdà im Vicentinischen.]

Monatsb. K. Preuss. Akad. Wiss. Berlin, 1877 (1878), 678-682. pl.

Add. 1877.1

Petersen, C. G. Johann. On the eggs and breeding of our Gobiidae. Rept. Danish Biol. Sta., 1892, 2, 1-8. 2 pls.

Add. 1892.1

— Aaleyngel til Udsættelse [Eel fry for planting] Dansk Fiskerit., 1911, 63.

Add. 1911.1

Petrone, Angelo. L'apparato reticolare endoglobulare di tutte le emasie. Atti Acad. Gioenis Sci. Nat. Catania, 1914, 5. ser. 7, mém. 16. 8 p. pl.

Add. 1914.1

In French as follows:

— L'appareil réticulaire endoglobulaire de toutes les hématies. Arch. Ital. Biol., 1914, 42, 78-88. pl.

Add. 1914.2

Anguilla, Tinca, Mugil, and Carassius studied.

Pettersson, Alfred. Experimentelle Untersuchungen über das Conserviren von Fisch und Fleisch mit Salzen. Akad. Abhandl., München, 1900. 70 p. 8°.

Add. 1900.1

Pettersson, O. Studien über die Bewegungen des Tiefenwassers und ihren Einfluss auf die Wanderungen der Heringe. Die Fischerbote, 1911, 3. Jahrg., 201-213; 237-249; 278-285.

Add. 1911.1

Pettigrew, James Bell [1834-1908] Animal locomotion; or walking, swimming, and flying, with a dissertation on aeronautics . . . Third edition. Internat. Sci. Ser., London, 1883, 7, xiii, 264 p. 3 pls. illust. 8°.

Add. 1883.1

The first edition appeared in 1874.
In this edition, flying fishes, p. 98-101; swimming fishes, p. 64-74.

Peupion, A. Traité de pisciculture. Paris & Nancy, 1898. 657 p. 8°.

Add. 1898.1

Pfeil, Joachim. Studien und Beobachtungen aus der Südsee. Braunschweig, 1899. 322 p. ill.

Add. 1899.1

Fishing with traps, spears, nets, hooks, 83-89. Tropical fishes; Their structures, colors and habits, 228-232.

Philibert, Henri. Aristotelis philosophia zoologica, etc. Paris, 1865. 96 p. 8°.

Add. 1865.1

Phillips, Barnet. The primitive fish-hook (In Mayer, A. M., Sport with

gun and rod, etc., p. 337-350. New York, 1883)

Add. 1883.1

Piana, Giovanni Pietro. Osservazioni sul *Tetracotylus perca-fluviatilis* Maulinié e su alcuni fenomeni verificati nei pesci persici. Giorn. Ital. Pesca, 1898, 2, 232-239. — Atti Soc. Ital. Sci. Nat., Milano, 1899, 37, 378-387.

Add. 1898.1

Pick, L. Der Schilddrüsenkrebs der Salmoniden. Berlin. Klin. Wochenschr., 1905, 1435-1544.

Add. 1905.1

Pictet, F. J. Lettre adressée . . . à M. P. de Loriol au sujet de divers poissons des étages supérieurs de la formation Jurassique du département de la Haute-Marne. (In Loriol, P. de, & others, Monographie paléontologique et géologique, &c. Mém. Soc. Linn. Normandie, Caen, 1872. 4°.)

Add. 1872.1

Piddington, H. Notice of an extraordinary fish. Journ. Asiatic Soc. Bengal, 1835, 4, 318-322.

Add. 1835.1
Rhineodon typus in Manila Bay.

Piers, Harry. Notes on Nova Scotian zoology. IV. Proc. Trans. Nova Scotian Instit. Sci., 1896-1897 (1898), 9, pt. 3, 255-267.

Add. 1898.1

Contains descriptions of two specimens of *Mola mola*.

Pietschmann, Viktor. Ueber das Geschlechtsverhältnis der Nachzucht bei Fischen, Blätt. Aquar.-Terrar. Kunde, 1911, 22. Jahrg., 257.

Add. 1911.1

Pigoreau, C. B. Nouveau traité de la pêche dans les fleuves et rivières navigables, avec lignes volantes et flottantes. Paris, 1828. 79 p. 2 pls. 12°.

Add. 1828.1

With the "Vade mecum" of C. Kresz added.

Pike, Nicholas. Sub-tropical rambles in the land of the Aphanapteryx. Personal experiences, adventures, and wanderings in and around the island of Mauritius. New York, 1873. 510 p. illust.

Add. 1873.1

Much data about fishes — well indexed.

Pilat, A. *Bothriocephalus punctatus* bei Fischen. Archiva Vet., Bucarest, 1905, 2, 138. — Abstracts in Zeitschr. Fleisch-Milch-hyg., Berlin, 1906, 16, 191. — Zeitschr. Infektionkr. Haustiere, Berlin, 1906, 1, 425-426. — Journ. Trop. Vet. Sci. Calcutta, 1906, 1, 479.

Add. 1905.1

Piper, H. Aktionsströme vom Gehörorgan der Fische bei Schallreizung. Zentralb. Physiol. 1906, **20**, 293-297.

Add. 1906.1

— Aktionsströme vom Labyrinth der Fische bei Schallreizung. Arch. Anat. Physiol., (Phys. Abth.), 1910 (1911), 1-13. 2 pls. — Centralb. Physiol., 1911, **25**, 1155-1156.

Add. 1911.1

Pittet, Léon. Contribution à l'étude de la répartition des sexes chez les poissons. Bull. Soc. Fribourg. Sci. Nat., 1914, **22**, 41-42.

Add. 1914.1

Pittman, E. F., & David, T. W. See **David & Pittman**.

Platt, Julia B. Fibers connecting the central nervous system and chorda in *Amphioxus*. Anat. Anz., 1892, **7**, 282-284.

Add. 1892.1

Plée, —. Manuscript note on poisoning by eating *Sphyraena barracuda* in the West Indies (In Cuvier and Valenciennes, Histoire naturelle des poissons. Paris, 1829. vol. iii, p. 346-349).

Add. 1829.1

Plehn, Marianne. Ueber die Verteilung von Fischegeln. Allgem. Fischerei Zeitg., München, 1898, **23**, 370-372.

Add. 1898.1

— Ein neuer Bacillus als Epidemieerregger beim Goldfisch (*Carassius auratus*). Deutsch. Fischerei Zeitg., 1900, **25**, 368.

Add. 1900.1

— *Trypanoplasma cyprini*, nov. sp. Abstracts in Journ. App. Micros., Rochester, 1903, **6**, 2706-2707. — Bull. Inst. Pasteur, Paris, 1904, **2**, 204-205.

Add. 1903.1

For article of which these are abstracts, see Plehn, Marianne, 1903.2.

— Ueber die Drehkrankheit der Salmoniden (*Lentospora cerebratis* (Hofer) Plehn) Arch. Protistk., 1904, **5**, 145-166. pl. 7 figs.

Add. 1904.1

Abstracts in Bull. Inst. Pasteur, Paris, 1905, **3**, 199-201. — Naturwiss. Wochenschr., Jena, 1905, **20** (n. f. **4**), 289-293. 4 figs. — Zool. Centralb., Leipzig, 1906, **13**, 587-588.

— Woher stammt die Drehkrankheit der Salmoniden? Allgem. Fischerei Zeitg., 1904, **29**, n. f. **9** (29), 151-153; 183-184. 2 figs. Abstract in Jahrest. Fortschr. Lehre Path. Microorg., Leipzig, 1906, **20**, 162-163.

Add. 1904.2

— *Sanguinicola armata* und *S. inermis* (n. gen., n. sp.) n. fam. Rhynchostomida. Ein entoparasitisches Turbellar im Blute von Cypriniden. Abstract in Zool. Centralb., Leipzig, 1905, **12**, 631-633.

Add. 1905.1

For original article, see Plehn, M., 1905.1

— Fische als Ueberträger der Krebskrankheit. Allgem. Fischerei Zeitg., 1909, 290-292.

Add. 1909.1

— Ueber einige bei Fischen beobachtete Geschwülste und geschwulstartige Bildungen. Ber. Bayr. Biol. Versuchstat. München, 1909, **2**, 2 pls. 2 figs.

Add. 1909.2

— La dégénérescence des truites arc-en-ciel. Bull. Soc. Cent. Aquicult. Pêche, Paris, 1912, **24**, 11-16.

Add. 1911.1

Translation from Allgem. Fischerei Zeitg. 1911.

— Die Furunkulose der Salmoniden. Zentralb. Bakteriolog. Parasitenk., Jena, 1911, **60**, 609.

Add. 1911.2

— Neuere Beobachtungen über Alter und Wachstum von Lachs und Forelle (Referat über eine Arbeit von Knut Dahl) Allgem. Fischerei Zeitg., 1911, n. s., **26**, 103-108.

Add. 1911.3

— Eine neue Karpfenkrankheit und ihr Erreger: *Branchiomyces sanguinis*. Zentralb. Bakteriolog. Parasitenk., 1912, **62**, 129-134. pl.

Add. 1912.1

Plehn, Marianne, & Mulsow, K. Der Erreger der "Taumelkrankheit" der Salmoniden. Zentralbl. Bakteriolog. Parasitenk. 1911, **59**, 1. Abth. 63.

Add. 1911.1

Pleininger, Wilhelm Heinrich Theodor, & Meyer, Christian Erich Hermann von. See **Meyer & Pleininger**.

Poeppig, Eduard Friedrich [1798-1868] Illustrierte Naturgeschichte des Thierreichs. Anatomie, Physiologie und Geschichte . . . der Fische, etc. 4 Bd. Leipzig, 1847-48. fol.

Add. 1847.1

Poey y Aloy, Felipe [1799-1891] For biographical notice, see Mestre, A. 1915.1.

Pogonowska, Irène. Materialien zur Histologie des Darmtrakts der Knochenfische, mit besonderer Berücksichtigung der elastischen Elemente. Bull. Intern. Acad. Sci. Cracovie, math.-nat. Cl., 1912, 1137-1157. pl. Add. 1912.1

Polara, G., & Bellecci, A. See **Bellecci & Polara.**

Pollard, E. C. A new sporozoon in *Amphioxus*. *Quart. Journ. Micr. Sci.*, 1893, **34**, 311-316. pl. Add. 1893.1

Pollini, C. Viaggio al Lago di Garda e al Monte Baldo in cui si ragiona delle cose naturali di quei luoghi aggiuntori un cenno sulle curiosità del Bolca e degli altri monte Veronesi. Verona, 1816. 152 pls. 8°. Add. 1816.1

Pomel, A. Description géologique et paléontologique de la Tour-de-Boulade et de Puy-de-Teiller, Puy-de-Dôme. *Bull. Géol. Soc. France*, 1844, 2. ser., **1**, 594. Add. 1844.1

— Mémoire pour servir à la géologie paléontologique des terrains tertiaires du département de l'Allier. *Bull. Soc. Géol. France*, 1846, 2. ser., **3**, 372. Add. 1846.1

— Catalogue méthodique et descriptif des vertébrés fossiles découverts dans le bassin hydrographique supérieur de la Loire et surtout dans la vallée de son affluent principal, l'Allier. Paris, 1853. Add. 1853.1

Tertiary fishes, 134-135.

Pontoppidan, Erich Ludvigsen [1698-1764] *Danske atlas e kongeriget Danmark med dets natürliche egenskater*. 3 vols. Kiöbenhavn, 1763-1767. figs. 4°. Add. 1763.1

Vols. IV-VII, after the death of the author, edited by Hofmann & Langbeck, Kopenhagen, 1771-1781.

— *Kurzgefasste Nachrichten, die Naturhistorie in Dännemark betreffend*. Kjöbenhavn & Hamburg, 1765. 17 pls. Add. 1765.1

Fishes, p. 177-191.

Another German edition, Flensburg, 1769.

— Jagttagelser ved skibes equipering til kabliau-fangst. *Saml. Handels-Mag. Isl.*, 1787, **1**, 59-96. Add. 1787.1

— Om Islandsk klipfisk. *Saml. Handels-Mag. Isl.*, 1787, **1**, 135-162. Add. 1787.2

— Om omkostningerne ved kabliaufangsten. *Saml. Handels-Mag. Isl.*, 1787, **1**, 22-28. Add. 1787.3

Ponzevra, C., & Fages, E. de. See **Fages & Ponzevra.**

Popoff, M. Determination of the food value of the most common kinds of fish [Text in Russian] (*Inaug. Dissert.*) St. Petersburg, 1882. Add. 1882.1

See also Herter, E. Add. 1889.1.

— On fish poison [Text in Russian] *Voyenno-Med. J.*, St. Petersburg, 1887, **158**, 3. sect., 65-84. Add. 1887.1

Popta, Canna. Vischen (In Gerdes Oosterbeek, W. F. *Encyclopædie van Nederlandsch Indië*. 4 vols. 1895-1905, **4**, 547-552.) Add. 1905.1

Portis, Alessandro. Di alcuni gimmodonti fossili italiani. *Boll. R. Comit. Geol. Ital.*, 1889, **20**, 352-380. pl. Add. 1889.1

Numerous new species of *Diodon*.

Portlock, Joseph Ellison [1794-1864] Report on the geology of the county of Londonderry, and of parts of Tyrone and Fermanagh, etc. *Geol. Survey Ireland, Dublin*, 1843. xxxi, 784 p. 54 pls. [5 col.]. ill. map. 8°. Add. 1843.1

Describes *Tristychius minor*, n. sp., ribbed spine from Carboniferous of Fermanagh, Ireland. p. 464.

Posada-Arango, Andres. Estudios científicos del doctor Andres Posada con algunos otros escritos suyos sobre diversos temas. Medellin, Colombia, 1909. 432 p. Add. 1909.1

Astroblepus said to possess ventral fins, p. 123. Fish fauna of Republic of Colombia, 285-310.

Pouchet, G. Accidents causés par l'usage de la viande des morues dites morues rouges; mesures à prendre pour en interdire la consommation. *Rec. Trav. Comité Consult. Hyg. Pub. France, Paris*, 1885 (1886), **15**, 395-398. Add. 1886.1

Powell, Wilfred. Wanderings in a wild country: or, three years amongst the cannibals of New Britain. London, 1884. 283 p. illust. Add. 1884.1

Fishing with hooks, p. 75 & 178, figs.; with nets, p. 75 & 195; with traps, p. 175, figs.; with poison vine, p. 177. Noosing sharks, p. 273-274, fig. Cassowary fishing, p. 271.

Pratt, A. E. Two years among New Guinea cannibals: a naturalist's sojourn among the aborigines of unexplored New Guinea. London, 1906. 12°. Add. 1906.1

Spider's web fishing net, p. 262-268. fig.

Pratt, Henry S. *Monocotyle floridana*, a new monogenetic trematode. Papers Tortugas Lab. Carnegie Instit. Washington, 1910, 4, 3-9. figs. (Pub. no. 133). Add. 1910.1

Trematode parasite in whip-ray, *Myliobatis freminvilli*.

Preiss, —. Plant lactones as fish poisons. Ber. Deutsch. Pharm. Gesellschaft. 1911, 21, 267. Add. 1911.1

Prenant, A. Recherches sur les vers parasites des poissons. Bull. Soc. Sci. Nancy, Paris, 1885 (1886), 2. ser., 7, 206-[230]. 2 pls. Add. 1886.1

Pressel, — Weist der Versuch, fremde Nutzfischarten in Württemberg einzubürgern, geringe Erfolge auf? Allgem. Fischerei Zeitg., 1900, 25, 96-100; 110-113. Add. 1900.1

Ergebnisse der Aussetzungen von *Salmo irideus* und *Salmo fontinalis*.

Prévost, Constant. Note sur un ichthyolite des rochers des Vaches-Noires [*Elops macropterus*]. Bull. Ferrussac, 1825, 267. Add. 1825.1

See also Prévost, C., 1824.1.

Priefer, B. Ueber die Funktion der Schwimmblase. Inaug. Dissert., Berlin, 1892. Add. 1892.1

Priem, Fernand [— 1919] Sur des poissons fossiles et en particulier des siluridés du Tertiaire supérieur et des couches récentes d'Afrique. Mém. Soc. Géol. France (*Paléont.*) 1914, 21, fasc. 3. 13 p. 2 figs. 5 pls. Add. 1914.1

Elasmobranchs and Siluroids of Chalouf, Egypt. Siluroids of Tchad.

— Sur des poissons fossiles des terrains tertiaires d'eau douce et d'eau saumâtre de France et de Suisse. Mém. Soc. Géol. France (*Paléont.*) 1914, 21, fasc. 3. 17 p. 4 pls. Add. 1914.2

Prince, Edward E. Fluctuations in the abundance of fish. 31. Ann. Rept. Dept. Mar. & Fish., Ottawa, 1898 (1899), xxxix-lv. Add. 1899.1

— Neglected structural features in young fry. 32. Ann. Rept. Dept. Mar. & Fish., Ottawa, 1899 (1900), lxxi-lxxiv. Add. 1900.1

— The object of a close time for fish. 32. Ann. Rept. Dept. Mar.

& Fish., Ottawa, 1899 (1900), lxxv-lxxvi. Add. 1900.2

— Water pollutions as affecting fisheries. 32. Ann. Rept. Dept. Mar. & Fish., Ottawa, 1899 (1900), li-lxx. Add. 1900.3

— The dog-fish plague in Canada. 36. Ann. Rept. Dept. Mar. & Fish., Ottawa, 1903 (1904), xliii-lviii. Add. 1904.1

— The maximum size of fishes and its causes. 36. Ann. Rept. Dept. Mar. & Fish., Ottawa, 1903 (1904), lix-lxvii. Add. 1904.2

— The Canadian sturgeon and caviare industries. 37. Ann. Rept. Dept. Mar. & Fish., Ottawa, 1904 (1905), liii-lxx. Add. 1905.1

— Methods of coarse fish extermination. 37. Ann. Rept. Dept. Mar. & Fish., Ottawa, 1904 (1905), lxxi-lxxxii. Add. 1905.2

— The pearlsides, a luminous fish new to Canada. Rod & Gun in Canada, 1913, 14, 1143-1145. Add. 1913.1

Pringle, (Sir) John [1707-1782] A discourse on the torpedo. (In Six discourses delivered by him, when President of the Royal Society. London, 1783, 43-89. 8°.) Add. 1783.1

— Discorso sulla torpedine, con appendice del traduttore. Scelta Opusc. Interess. 1792, 15, 15-65. Add. 1792.1

Prinsep, J. Fall of fish from the sky. Journ. Asiatic Soc. Bengal, 1833, 2, 650-651. Add. 1833.1

Pritchard, W. T. Polynesian reminiscences; or life in the South Pacific islands. London, 1866. Add. 1866.1

Fishing in Samoa, chap. 8.
"Tickling" sharks at Aitutaki, p. 172-173.

Prochorov, P. The poisonous character of some kinds of lamprey [Text in Russian] Vrach, St. Petersburg, 1884, 5, 54. Add. 1884.1

Provancher (l'Abbé) — Faune canadienne. Les poissons. Naturaliste Canadien, 1875, 7, 98-108; 129-134; 161-170; 193-198; 225-232; 257-263; 289-296; 321-327; 361-363. *Ibid*, 1876, 8, 5-12; 65-72; 97-105; 129-134; 161-166; 193-197; 225-230; 257-263; 289-300. Add. 1875.1

Pütter, A. Vergleichende Physiologie. Jena, 1911. 721 p. 174 text figs. Add. 1911.1

For various references to fishes, see his indices.

Pullen-Burry, Bessie. In a German colony, or four weeks in New Britain. London, 1909. 238 p. 8 illust. Add. 1909.1

Fishing with nets and wiers, p. 195; with narcotized fishes for bait, p. 196.

Pulman, G. P. R. Vade mecum of fly-fishing for trout, being a complete and practical treatise on that branch of the art of angling. London, 1851. xii, 186. p. 8°. Add. 1851.1

Other editions are: London, 1841, and 1846 (2nd ed., rewritten and enlarged).

Putnam, Frederick Ward [1839-1915] [Remarks on oral gestation in chromoid fishes from South America] Proc. Boston Soc. Nat. Hist., 1863, 9, 226. Add. 1863.1

Oral gestation first made known for cichlid fishes.

— Remarks on Amphioxus [*A. caribbæus*]. Proc. Boston Soc. Nat. Hist., 1862-63 (1865), 9, 334. Add. 1865.1

— Annual report of curator of ichthyology, 1867. Proc. Boston Soc. Nat. Hist., 1868, 11, 172-173. Add. 1868.1

— On monstrosities in trout, 1869. Bull. Essex Inst., 1870, 1, 31-32. Add. 1870.1

— Notes on fishes and insects from Ipswich river, 1874. Bull. Essex Inst. 1875, 6, 121. Add. 1875.1

— The way bone fish-hooks were made in the Little Miami valley. Rept. Peabody Mus. Amer. Archaeol. Ethnol., Cambridge, 1887, 3, 581-586. 11 figs. Add. 1887.1

— Note on *Belostoma* in carp ponds, 1886. Proc. Boston Soc. Nat. Hist., 1888, 23, 336. Add. 1888.1

— Note on bone fish-hooks, 1885. Proc. Boston Soc. Nat. Hist., 1888, 23, 240. Add. 1888.2

Pylaie, — de la. Recherches en France sur les poissons de l'océan pendant les années 1832 et 1833. Cong. Scient. France, Poitiers, 1834 (1835), 2. sess., 524. Add. 1835.1

Complete citation for Pylaie, — de la. 1834.1.

Pyle, Howard. Among the Thousand Islands (In Mayer, A. M. Sport with gun and rod. New York, 1883, 573-596. figs.) Add. 1883.1

Fishing for muskallonge in the St. Lawrence.

Q

Quelch, T. J. [Exhibition of a supposed hybrid fish of the genus *Rhombus*] Proc. Zool. Soc. London, 1869, 473. Add. 1869.1

Quenstedt, Friedrich August von [1809-1889] Handbuch der Petrefaktenkunde. Tübingen, 1852. 792 p. 62 pls. Add. 1852.1

Describes new genera, *Selachidæ*, p. 173; *Serrolepis*, p. 207; and *Pleurolepis*, p. 214. Other editions: 1866, 1885.

Quidor, A. Sur le *Leposphilus labrei* Hesse et sur la famille des Philichthyidæ. C. R. Acad. Sci. Paris, 1906, 142, 230-232. Add. 1906.1

R

- R.** — Zur Frage über die Ernährung der Fische. Allgem. Fischerei Zeitg., 1911, n. s. **26**, 78–79. Add. 1911.1
- Rabbeno, Aronne.** La legislazione sulla pesca in Italia. Prefazione — dottrina e giurisprudenza per . . . A. Martinelli. Testo e commento dei regolamenti per A. Rabbeno. Torino, 1883. 568 p. 8°. Add. 1883.1
- Rabl, Carl.** Theorie des Mesoderms. Morph. Jahrb., 1889, **15**, 113–252. 4 pls. 9 text-figs. *Ibid.*, 1893, **19**, 65–144. 4 pls. 4 text-figs. Add. 1889.1
Based almost wholly on study of Elasmobranch embryos.
For third paper of series see Rabl, C., 1896.1.
All three of these papers were republished as:
—— Theorie des Mesoderms. Leipzig, 1897. 362 p. 15 pls. Add. 1897.1
- Rabl-Rückhardt, Hermann.** Das Gehirn der Knochenfische. Veröffentl. Ges. Heilk., Berlin, 1884 (1885), 202–230. Add. 1885.1
See also Rabl-Rückhardt, H., 1885.1.
- Raciborski, M.** Vegetable parasites of carp [Text in Polish] Rozpr. Wydz. Matemat. Przyrod. Akad., Krakow, 1886, **14**, 149–168. Add. 1886.1
- Radcliffe, Lewis** [1880–] Notes on some North Carolina sharks and rays. Trans. Amer. Fisheries Soc., 1914, 37–40. Add. 1914.1
- Radermacher, Daniel.** Bericht over de keering van't water in een vyver. Verh. Genootsch. Vlissingen, 1773, **3**, 592. Add. 1773.1
- Radlkofer, L.** Ueber fischvergiftende Pflanzen. Sitzber. Akad. Wiss. München, mat.-phys. Kl., 1886, **16**, 379–416. Add. 1886.1
- Raffaele, Federico.** Metamorfosi del *Lepidopus caudatus*. Boll. Soc. Nat. Napoli, 1889, **3**, 31–33. Add. 1889.1
- Raffles, (Sir) Thomas Stamford.** For biographical memoir see Bennett, E. T. 1830.1
- The history of Java. 2 vols. London, 1830. Add. 1830.1
Methods of fishing, vol. i, p. 207–209.
- Rafinesque-Schmaltz, Constantine Samuel** [1783–1840] Additions to the observations on the sturgeons of North America. Amer. Monthly Mag., 1817, **1**, 288. Add. 1817.1
Acipenser fulvescens, n. sp. Reprinted by Hubbs in Copeia, 1917, no. 44, 48.
- A life of travels and researches in North America and south Europe. 1st ed. Philadelphia, 1836. 12°. Add. 1836.1
- Raillet, A.** Maladie des barbeaux causée par des psorospermes. Bull. Mém. Soc. Centr. Méd. Vet., Paris, 1886, **40** (n. s. **4**), 134–137. Add. 1886.1
- Traité de zoologie médicale et agricole. 2. ed. Paris, 1895. 1303 p. Add. 1895.1
First ed. published, 1885–86.
Fishes, from standpoint of food and of poisonous qualities, p. 949–976.
- Rakoczy, A.** Vergleichende Untersuchungen über die Verdauungsfermente der Kalt- und Warmblüter. 1. Hecht- und Hundepepsin. Zeitschr. Physiol. Chem., 1913, **85**, 349–371. Add. 1913.1
- Ramsay, Edward Pierson.** Description of a new species of *Oligorus* [*O. terræ-reginæ*]. Proc. Linn. Soc. New South Wales, 1880, **5**, 93–95. fig. Add. 1880.1
- Description of a new species of *Therapon* (*T. macleayana*) from the Macquarie river. Proc. Linn. Soc. New South Wales, 1881, **6**, 831–833. Add. 1881.1
- Description of a new species of *Coris* [*C. picta*] from Lord Howe Island and New South Wales. Proc. Linn. Soc. New South Wales, 1882, **6**, 301. Add. 1882.1
- Ramsay, E. P., & Ogilby, J. D.** Description of a new *Tripterygium* [*T. striaticeps*] from Port Jackson. Proc.

Linn. Soc. New South Wales, 1888, 2. ser. 3, pt. 1, 419-420. Add. 1888.1

— On the genus *Tetragonurus* of Risso. Proc. Linn. Soc. New South Wales, 1888, 2. ser., 3 (pt. 1), 9-16. Add. 1888.2

Rathbun, Richard. Report on the inquiry respecting food fishes and the fishing grounds. Rept. U. S. Fish Comm., 1888-89 (1892), 16, xli-cvii. Add. 1892.1

— Summary of the fishery investigations conducted in the North Pacific ocean and Bering sea from July 1, 1888, to July 1, 1892, by the United States Fish Commission steamer "Albatross." Bull. U. S. Fish Comm., 1892 (1894), 12, 127-201. 5 charts. Add. 1894.1

— Report upon the inquiry respecting food-fishes and the fishing-grounds. Rept. U. S. Fish Comm., 1893 (1895), 19, 17-51. Add. 1895.1

— Report upon the inquiry respecting food-fishes and the fishing-grounds. Rept. U. S. Fish Comm., 1894 (1896), 20, 81-114. Add. 1896.1

— A review of the fisheries in the contiguous waters of the state of Washington and British Columbia. Rept. U. S. Fish Comm., 1899 (1900), 251-350. Add. 1900.1

Rathbun, Richard, & Wakeham, William. Report of the joint commission relative to the preservation of the fishes in the water contiguous to Canada and the United States. House Doc. no. 315. 54. Congress, 1897, 2 sess., 14-178. Add. 1897.1

Rathke, Martin Heinrich. Abhandlungen zur Bildungs- und Entwicklungs-Geschichte des Menschen und der Thiere. Zweiter Theil. Leipzig, 1833. Add. 1833.1

i. Bildungs- und Entwicklungs-Geschichte des *Blennius viviparus* oder des Schleimfisches, 3-68. Tab. I-V. 67 figs.

Rätz, Stephan von. Beiträge zur Parasitenfauna der Balatonfische. Centralb. Bakteriöl. Jena, 1897, 22 (1. Abth.), 443-453. fig. Abstract in Berlin. Thierartzl. Wochenschr., 1899, 557. Add. 1897.1

Ratzeburg, — & Brandt, J. F. See Brandt & Ratzeburg.

Rautenfeld, E. von. Skelett der hinteren Gliedmassen von Ganoiden und Teleostiern. Morph. Jahrb., 1884, 9, 325-326. Add. 1884.1

Abstract of Rautenfeld, E. von, 1882.1

Ravenel, William de Chastignier. Report on the exhibit of the United States Fish Commission at the Tennessee Centennial Exposition in 1897. Rept. U. S. Fish Comm. 1898 (1899), 329-339. Add. 1899.1

— Report on the propagation and distribution of food fishes. Rept. U. S. Fish Comm. 1898 (1899), xxxi-cxxii. Add. 1899.2

— Report on the propagation and distribution of food-fishes. Rept. U. S. Fish Comm. (1899), 1901, xxxv-cxviii. Add. 1901.1

Raveret-Wattel, Casimir. La coloration des poissons. Le Pêcheur, 1907, 18, 767. Add. 1907.1

— Atlas de poche de poissons de mer de la France et de la Belgique, avec un appendice sur les cétacés. Paris, 1909. 264 p. 72 pls. 16°. Add. 1909.1

— Carp culture in France. Trans. Amer. Fisheries Soc. 1910 (1911), 426-248. Add. 1911.1

Translation of his article, 1911.2.

— La pisciculture industrielle. Paris, 1914. 408 p. illust. 12°. Add. 1914.1

Raveret-Wattel, —, & Bartet, —. Reproduction of California salmon in the aquarium of Trocadéro. Bull. U. S. Fish Comm., 1883, 3, 207-208. Add. 1883.1

Rawling, C. G. The land of the New Guinea pygmies. London, 1913. 366 p. Add. 1913.1

Fish and fishing, p. 68, 288, 340. Spider-web fish-net, p. 289.

Rayer, Pierre François Olive [1793-1867] Exposé succinct des principales observations faites jusqu'à ce jour sur les maladies et sur les anomalies des poissons. Arch. Méd. Comp., Paris, 1843, 1, 245-308. Add. 1843.1

Reche, Otto. Der Kaiserin-Augusta-Fluss. II. Ethnographie: A. Melanesian, Bd. I, in Ergebnisse der Südsee-Expedition, 1908-1910, G.

Reche, O.

Thilenius Herausg. in Hamburgische Wissenschaftliche Stiftung, 1913.

Add. 1913.1

Fishing apparatus; spears, hooks, baskets, etc.; p. 247-251. pls. & text-figs.

Redeke, Heinrich Carl. Het nieuwe Engelsche zeevischerij-verslag. Meded. Vissch., Helder, 1906, **13**, 166-169; 177-179.

Add. 1906.1

— Jets over de Noordzee-Haring. Meded. Vissch., 1906, **13**, 43-45; 65-69; 93-96; 117-120.

Add. 1906.2

Reed, Hugh Daniel. Notes on the poison organs in fishes. Science, 1906, n. s. **24**, 293.

Add. 1906.1

Axillary poison glands are found in all species of Noturus and Schilbeodes.

Rees, Abraham. Cyclopædia; or universal dictionary of arts, sciences and literature. Philadelphia, 1819.

Add. 1819.1

Rain of fishes in Paris, vol. xxx.

Reeves, E. Gordon, Willey, A., & Green, E. Ernest. Bee-eaters as fish-eaters. Spolia Zeylanica, 1910, **7**, 48-49.

Add. 1910.1

Insectivorous birds feeding on fish in Ceylon.

Regan, Charles Tate. The largest shark [*Rhineodon typus*] Fishing Gazette, London, 1913, 459.

Add. 1913.1

Regnard, Paul. Recherches expérimentales sur les conditions physique de la vie dans les eaux. Paris, 1891. vii, 500 p. 8°.

Add. 1891.1

Regnard, Paul, & Jolyet, Felix. See Jolyet & Regnard.

Reichelt, Julius. *Luciocephalus pulcher*, lebendgebärender Hecht aus Sumatra, und *Osphromenus malayanus*, lebendgebärender Gurami. Wochenschr. Aquar.-Terrar. Kunde, 1906, **3**, Jahrg., 4-5; 122-123.

Add. 1906.1

Reichenow, Anton [1847-] For bibliographical notice see Schalow, H. 1869.1.

Reighard, Jacob. On the handling of adhesive eggs. Trans. Amer. Fisheries Soc., 1893, 51-60.

Add. 1893.1

— The breeding habits of certain fishes. Science, 1902, n. s. **15**, 380-381.

Add. 1902.1

Amia and *Eupomotis*.

Reinaud, Joseph Toussaint. Relations des voyages fait par les Arabes

et Persans dans le neuvième siècle de l'ère chrétienne. 2 vols. Paris, 1845.

Add. 1845.1

Poissons, vol. ii, p. 84-95.

Reindl, J. Bayerns in historischer Zeit ausgerottete und ausgestorbene Tiere. Ein Beitrag zur Zoogeographie. Mitth. Geogr. Ges. München, 1906, **2**, 41-82.

Add. 1906.1

Hausen, Sterlett und Messerkarpfen (*Pelecus cultratus*).

Reinhard, W. Zur Frage über die amitotische Teilung der Zellen. Biol. Centralb., Leipzig, 1896, **16**, 420-426.

Add. 1896.1

Eggs of *Leuciscus*.

Reinhart, H. Vom Gehör der Fische. Wochenschr. Aquar.-Terrar. Kunde, 1913, 10. Jahrg., 358-359.

Add. 1913.1

Reis, Otto M. Ueber *Belonostomus*, *Aspidorhynchus* und ihre Beziehung zur lebenden *Lepidosteus*. Sitzber. K. Bayer. Akad. Wiss., math.-phys. Kl., 1887 (1888), **17**, 151-177. 2 pls.

Add. 1888.1

Rejsek, J. On the peculiar formation of the proximal end of the spinal marrow in *Trigla gunardus* (Text in Bohemian) Česká Akad. Císaře Františka Josefa, Prague, 1898, Rozpravy, **2**, Roč. vii, čís. 15. 10 p. 2 pls. 8°.

Add. 1898.1

Rembold, R. Einige Beobachtungen hinsichtlich des gemeinen Schleimfisches (*Blennius vulgaris* Polini) Blätt. Aquar.-Terrar. Kunde, 17. Jahrg., 203-205. fig.

Add. 1906.1

Remeš, Mauric. Fauna t. zv. exotických balvanu štramberského vavence v. Rychhalticich na Morané (Exotic fauna found in limestone boulders, Moravia) Rozpr. Česká Ak. Františka Josefa, 1906, **14**, no. 6, 1-9.

Add. 1906.1

Remlinger, — & Nouri, Osman. Les poissons peuvent-ils transmettre la fièvre typhoïde ou le choléra. C. R. Mém. Soc. Biol. Paris, 1908, **64**, 361-362.

Add. 1908.1

Rensen, P. v., Dantziger, C., & Freeden, W. v. See Freeden, Dantziger, & Rensen.

Retzius, A., & Müller, J. See Müller & Retzius.

Retzius, Magnus Gustav. [1842-1919] *Zur Kenntnis vom Bau der Selachier-retina.* Biol. Untersuch., 1905, 12, 55-60. pl. Add. 1905.1

Reuss, J. D. [1750-1831] *Repertorium commentationum a Societatibus Literariis editarum scientia naturalis.* 2 vols. Gottingiæ, 1801 & 1802. 574 & 414 p. Add. 1801.1

Vol. i. *Historia naturalis, generalis et zoologia.*

Vol. ii. *Oeconomia — Res piscatoria.*

Reuter, —. *Die Fischerei in den Gewässern des Forstreviers Siehdichum.* Mitt. Fischerei Ver. Provinz Brandenburg, 1900, Heft 1, 1-33. Add. 1900.1

Rhead, Louis. *Bird and animal anglers.* Bienn. Rept. Comm. Fisheries & Game Indiana 1907-08 (1908), 284-298. Add. 1908.1

Ribart, —. *Description d'un poisson monstrueux, pêché à Cette, nommé le moine.* Mém. Acad. Sci. Paris, 1759, (Hist.) 40. Add. 1759.1

Apparently this refers to Cephaloptera.

Ribas, Cadaval. *Tratado das peixes do Brazil sob ponto de vista commercial e industrial.* Bol. Minist. Agric., Rio de Janeiro, 1913, 3, 74-87. Add. 1913.1

Ribbe, Carl. *Zwei Jahre unter den Kannibalen der Salomon-Inseln.* Dresden & Blasewitz, 1903, vii, 352 p. pls. & figs. Add. 1903.1

For numerous references to methods of fishing (with poisons, kite, etc.), see his index.

Ribeiro, Alipio de Miranda. *Sobre alguns peixes novos para a fauna marinha do Brazil.* Bol. Minist. Agric. Serv. Informa., Rio de Janeiro, 1912, 1, 15-19. Add. 1912.1

This is the complete reference for Ribeiro, A. de M., 1910.1

Ricci, James Herman de. *Fiji; our new province in the South Seas.* London, 1875. 332 p. Add. 1875.1

Fishing with torches and nets, p. 42; with poisons (Barringtonia and Derris), p. 42. Sharks in Rewa river, p. 214. Native names of fishes, p. 304.

— *The fisheries dispute and annexation of Canada.* London, 1888. 310 p. 12°. Add. 1888.1

Richardson, John [1787-1865] *Notice of the fishes* (In Franklin, John. *Narrative of a journey to the shores of*

the Polar Sea in 1819-22 . . . with an appendix on various subjects relating to science and natural history. London, 1823. xvi, 768 p. illust. 4°.)

Add. 1823.1

Fishes, p. 705-728. 2 pls.

— *Fishes* (In Back, Sir Geo. *Narrative of the Arctic land expedition to the mouth of the Great Fish River, and along the shores of the Arctic Ocean in . . . 1833-1835.* London, 1836. x, 663 p. 14 pls. map. 8°.) Add. 1836.1

Richet, Ch. *Des propriétés chimiques et physiologiques du suc gastriques chez l'homme et les animaux.* Journ. Anat. Physiol., Paris, 1878, 14, 170-333. pl. Add. 1878.1

Fishes, p. 181-185; 238-248. Figures of stomachs of pike and Lophius.

— *Des microbes chez les poissons et les animaux marins.* C. R. Mém. Soc. Biol., 1882, 7. sér. 4 (34), 669-675. Add. 1882.1

Richet, Ch., & Olivier, L. See **Olivier & Richet.**

Richiardi, Sebastiano. *Sulla Clupea sprattus e sul Lernæenicus sprattæ.* Proc. Verb. Soc. Tosc. Sci. Nat., 1880, 101. Add. 1880.1

Rico, B. *L'aquiculture en Auvergne.* Bull. Soc. Acclim., Paris, 1876, 3. sér. 3, 165-191. 2 figs. Add. 1876.1

Riddell, W., & Herdman, W. A. See **Herdman & Riddell.**

Riedel, K. *Etwas über mein Seewasseraquarium.* Blätt. Aquar.-Terrar. Kunde, 1906, 17. Jahrg., 370-374; 375-378; 391-393. Add. 1906.1

Mit Figuren von *Gobius niger* und *Pleuronectes flesus*. Allgemeines und Biologisches über *Trachinus draco*, *Solea vulgaris* und andere Fische.

Riemann, Johann Friedrich. *Praktische Anweisung zum Teichbau.* Für Förster, Oekonomen, und solche Personen, die sich weniger mit der Mathematik abgeben. Leipzig, 1798. 444 p. 4 pls. sm. 8°. Add. 1798.1

— *Praktischer Abriss des Fischereywesens für Oekonomen, Camera-listen und Liebhaber der Fischereyen.* Leipzig, 1804. 268 p. 8°.

Add. 1804.1

Riepe, E. *Einige Daten über das Alter der Goldfische und deren Abarten.* Wochenschr. Aquar.-Terrar. Kunde, 1906, 3. Jahrg., 347-348. Add. 1906.1

Riggenbach, E. Das Genus Ichthyotænia (*Inaug. Dissert.*) Geneva, 1896. — Rev. Suisse Zool., 1896, 4, 165–276. 3 pls. Add. 1896.1

Ringer, Sidney, & Buxton, D. W. Concerning the action of small quantities of Ca, Na, and K salts upon the vitality and function of contractile tissues and the cuticular cells of fishes. Journ. Physiol., 1884, 6, 154. Add. 1884.1

Rivers, W. H. R. The history of Melanesian society. 2 vols. London, 1914. ill. Add. 1914.1

The many references in the index show the important part played by fish and fishing in the lives of these people.

Rivers, W. H. R., & Haddon, A. C. See **Haddon & Rivers.**

Rivière, —. Mémoire sur les dents pétrifiées de divers poissons comparées avec les dents des mêmes poissons nouvellement pêchés. Hist. Soc. Roy. Sci. Montpellier, Lyon, 1766, 1, 75. Add. 1766.1

Roaf, H. E. Contributions to the physiology of marine organisms. II. The influence of the carbon dioxide and oxygen tensions on rhythmical movements. Journ. Physiol., 1912, 43, 449–454. Add. 1912.1

Collus scorpius experimented on.

Robertson, M. Transmission of flagellates living in the blood of certain freshwater fishes. Proc. Roy. Soc. London, 1911. 22 p. 2 pls. Add. 1911.1

Robinson, J. Albert. Fish scrap; its manufacture and fire hazards. Rept. Underwriters' Bureau New England, 1912, no. 137. Add. 1912.1

— Some sardine factories. Rept. Underwriters' Bureau New England, 1912, no. 136. Add. 1912.2

Rochaz, — Referat über Ketschekian: Nouvelles recherches sur les larves de *Dibothriocephalus latus*. Zentralbl. Bakteriöl. Parasitenk., 1911, 49, no. 7 (*Referate*) Add. 1911.1

Von 301 untersuchten Fischen aus dem Genfer See waren 181 mit *Bothriocephalus* finnen infiziert.

Roché, Georges. La culture des mers en Europe. Pisciculture — pisciculture — ostréiculture. Paris, 1898. 328 p. pl. illust., 2 maps. 8°. Add. 1898.1

Forming vol. 87 of the "Bibliothèque scient. internat."

Rodd, Edward Hearle. Boar-fish at the Scilly isles. Zoologist, 1870, 2. ser. 5, 2410. Add. 1870.1

Rodel, Albert. La pêche à la sardine à Arcachon. Bull. Trim. Enseign. Pêches Maritimes, 1913, 18, 230–243. 2 pls. Add. 1913.1

Rodway, James. In the Guiana forest. New ed. Chicago, 1912. 326 p. illust. Add. 1912.1

Fishing and fishes, p. 83–98.

Röse, Anton Ferdinand. Petri Artedi Angermannia — Sueci synonymia nomenclum piscium, etc. 2nd ed. Greifswald, 1793. Add. 1793.1

"This article, published as a supplement to Walbaum's Artedi Piscium, enumerates the generic names of Artedi and others, the species in their original polynomial form. In an appendix are given a few new generic names, mostly taken from Aristotle. These genera are not described, nor are their species named, but the synonymy is fully given. Some of them had been already used by other authors." D. S. Jordan.

Rogers, J. M. West Indian poisonous fishes. Pop. Sci. Monthly, 1899, 55, 680–685. Add. 1899.1

Rohde, E. Histologische Untersuchungen über das Nervensystem von *Amphioxus lanceolatus*. Zool. Beitr. Breslau, 1888, 2, 169–211. 2 pls. Add. 1888.1

— Muskel und Nerven. II. Mermis und Amphioxus. Zool. Beitr., Breslau, 1891, 3, 161–182. 4 pls. Add. 1891.1

Amphioxus, p. 165–178.

— Histogenetische Untersuchungen. II. Ist die Chromatindiminution eine allgemeine Erscheinung der reifen Zellen bzw. der sich entwickelnden Gewebe, der Prozess der Reifeteilungen der Geschlechtszellen nur ein spezieller Fall dieses Vorganges und der definitive Verlust des Kernes bei den roten Blutzellen der Säuger das Endglied dieser Erscheinungsreihe? Zeitschr. Wiss. Zool., 1911, 98, 1–30. Add. 1911.1

Mustelus and *Trutta* are considered.

Rohn, —. [Exhibition of *Serranus cylindricus* Gthr.] Proc. Linn. Soc. New South Wales, 1888, 2. ser. 3, pt. 3, 1316. Add. 1888.1

Rohon, J. Victor. Ueber einen Mesozoischen Fisch vom Altai. Bull. Soc. Impér. Naturalistes Moscou, 1892, n. s. 6, no. 1. 10 p. pl. Add. 1892.1

Lepidotus altaicus, n. sp. (p. 85), Jurassic of River Kenderlyk in Maikantschatschai Mts., Siberia.

Rohr, J. B. von. Vollständiges Ober-Sächsisches Hausswirtschafts-Buch, welches die Hausswirtschafts-Regeln, bei dem Feld-Bau, der Gärtnerey, den Jagd- und Forst-Sachen, Fischen und Teichen, . . . in dem Marggraffthum Meissen appliciren lassen. Leipzig, 1772. 7 Bl. 1446 S. 17 Bl.
Add. 1772.1

Rolle, Friedrich. Ueber die geologische Stellung der Sotzka-Schichten in Steiermark. Sitzb. Akad. Wiss. Wien, 1858, 30, 3-33. 2 pls.
Add. 1858.1

List of Oligocene fossils of Wurzenegg, Styria, Austria.

Romano, Anacleto. Di alcune particolarità nella fina anatomia delle cellule nervose elettriche. Napoli, 1901, 48 p. pls.
Add. 1901.1

The electric nerve cells of Torpedo and Raja.

Romilly, H. H. From my verandah in New Guinea: sketches and traditions. London, 1889. 277 p.
Add. 1889.1

General statement about fishing in southern waters of New Guinea, p. 166-168; 30-ft. sharks in Redscar bay, p. 169.

Ronalds, Alfred. The fly-fisher's entomology. Illustrated by coloured representations of the natural and artificial insect. And accompanied by a few observations and instructions relative to trout and grayling fishing. London, 1883. xiv, 132. 20 pls. 8°.
Add. 1883.1

This is the ninth edition, the first was published London, 1836.

See also Ronalds, Alfred, 1836.1

Ronsseus, — Von einem grossen Rogen eines Herings. Neue Gesellsch. Erzähl., 1759, 2, 259.
Add. 1759.1

— Ob das Hering essen gesund sey. Berlin. Samml., 1778, 10, 217.
Add. 1778.1

Rosén, Nils. Studies on the Plecognaths. 2. The air sac, with notes on other parts of the intestines. Abstract in Centralb. Zool. & Exper. Biol., 1912, 1, 977.
Add. 1912.1

For original article, see Rosén, N., 1912.1

Rosenbaum, Walther. Die Entwicklung der Knochenfische im Ei. Blätt. Aquar.-Terrar. Kunde, 1913, 24. Jahrg., 181-183. 3 figs.
Add. 1913.1

Rosenthaler, L. Phytochemische Untersuchungen der Fischfangpflanze

Verbascum sinuatum L., und einiger anderer Scrophulariacum. Arch. Pharm. Berlin, 1902, 240, 57-69. Add. 1902.1
Inaug. Dissert., Strassburg, 1901.

Ross, William F. Studies of fishes of central Pennsylvania. Rept. Fish. Comm. State of Pennsylvania, 1902, 111-124.
Add. 1902.1

Rossmassler, E. A. Das Süswasser-Aquarium. Leipzig, 1880. 105 p. illust. 8°.
Add. 1880.1

Rost, Günther. *Barbus phutunio* Ham. Buch. Wochenschr. Aquar.-Terrar. Kunde, 1914, 11. Jahrg., 240-241. fig.
Add. 1914.1

Rostoshinski, R. P. Case of poisoning by fish (Text in Russian) Protok. Tambov. Med. Obsh., 1892, 23, 137-143.
Add. 1892.1

Roth, Henry Ling. Use of sucker-fishes (Echeneis) in fishing. Nature, 1889, 39, 342.
Add. 1889.1

— The natives of Sarawak and British North Borneo, based chiefly on the manuscripts of the late Hugh Brooke Low, Sarawak Government Service. 2 vols. London, 1896.
Add. 1896.1

Fishing, vol. i, p. 454-464; with seines and nets, p. 454-458; with the tuba (*Derris elliptica*) root, p. 458-459; angling, spinning, trapping, etc., p. 462-464.

Roth, Walter E. Ethnological studies among the north-west central Queensland aborigines. Brisbane & London, 1897, xvi, 199 p. 23 pls. 8°.
Add. 1897.1

Fishing, p. 94-96. Poisoning the water with a shrub, Tephrosia, p. 95.

— Food; its search, capture and preparation. North Queensland Ethnogr. Bull., 1901, no. 3. Add. 1901.1

Fishing methods; spears, hooks, nets, wiers, poisons (22 kinds), Remora, etc., p. 19-24. figs.

Roth, Wilhelm. Ueber die Verschleppung von Aquarienfischen in die öffentlichen Gewässer und ihre event. Bedeutung für die einheimischen Fische bezw. das Fischereiwesen. Wochenschr. Aquar.-Terrar. Kunde, 1906, 3. Jahrg., 417-419.
Add. 1906.1

— Beiträge zur Kenntniss der parasitären Fischkrankheiten. Arch. Naturg., 1907, 67. Jahrg., 2, 150.
Add. 1907.1

Roule, Louis. Les larves marines. Bull. Soc. Zool. France, 1899. 117-135. figs. Add. 1899.1

Brief popular description of fish larvæ, p. 132-133.

— La biologie et la pêche du thon dans la Méditerranée occidentale. Rev. Gén. Sci. Paris, 1914, 25, 808-814.

Add. 1914.1

— Description préliminaire d'un poisson abyssal nouveau, (*Grimaldichthys profundissimus*), recueilli dans l'océan Atlantique à 6035 mètres de profondeur, par S. A. S. le Prince de Monaco. C. R. 9. Congrès Internat. Zool. Monaco, 1914, 498-501.

Add. 1914.2

Roulland, Franç. Observations sur les ichthyosarcolites et sur les hipurites. Angoulême, 1829. 20 pp. pl. — Bull. Soc. Linn. Bordeaux, 1829, 3, 197-210. — Bull. Sci. Nat. (Férussac), 1829, 26, 197.

Add. 1829.1

— Nouvelles observations sur les ichthyosarcolites. Act. Soc. Linn. Bordeaux, 1830, 4, 164-166. 3 pls. — Bull. Sci. Nat. (Férussac), 1831, 24, 146.

Add. 1830.1

Rouvière, H. Etude sur le développement phylogénique de certains muscles soughyoidiens. Journ. Anat. Physiol. Paris, 1906, 42, 487-540. 3 pls.

Add. 1906.1

Raja marginata, *Scyllium canicula*, and *Trutta fario* studied.

Royle, J. Forbes. On the production of isinglass along the coasts of India, with a notice of the fisheries. London, 1842. viii, 94 p. 8°. Add. 1842.1

This was written under the authorization of and presumably printed by the India House. The same year it was reprinted as the next number.

— Production of isinglass on the coasts of India, with a notice of its fisheries. Journ. Nat. Hist., Calcutta, 1842-43 (1843) 3, 76-116.

Add. 1843.2

Rudolphi, Carl Asmund. Ueber den Olm. Isis, 1817, 1, 118-119.

Add. 1817.1

External gills in sharks referred to.

Rücke, — Die künstliche Aufzucht der Hechtbrut. Fischerei Zeitg. Neudamm, 1911, 14, 199-200.

Add. 1911.1

Rückert, Johann. Ueber die Entstehung der Parablast- oder Dotter-

kerne bei Elasmobranchiern. Sitzber. Ges. Morph. Physiol., Munich, 1890, 6, 161. Add. 1890.1

— Ueber die Befruchtung bei Elasmobranchiern. Verh. Anat. Ges., 1891, 5, 253-254. Add. 1891.1

— Entwicklung der Exkretionsorgane. Ergebn. Anat. Entwicklungsgesch., Anat. Hefte, 2. Abth., 1891-92 (1892), 1, 606-695.

Add. 1892.1

An extensive review of the subject and its literature chiefly as regards fishes.

— Ueber physiologische Polyspermie bei meroblastischen Wirbeltiereneiern. Anat. Anz., 1892, 7, 320-333, 2 figs.

Add. 1892.2

Eggs of fishes used in part.

— Ueber die Abstammung der bluthaltigen Gefässanlagen beim Huhn und über die Entstehung des Randsinus beim Huhn und bei Torpedo. Sitzb. Bayer. Akad. Wiss., München, 1903, 32, 487-498. pl.

Add. 1903.1

Rückert, J., & Mollier, S. Die erste Entstehung der Gefässe und des Blutes bei Wirbeltieren (In Hertwig, O., Handbuch Entwicklungslehre der Wirbeltiere, 1906, Bd. I, Th. 1, 2. Hälfte, p. 1019-1272. 274 figs.)

Add. 1906.1

i. Heart of Cyclostomes, Ganoids, and Selachians, p. 1030-1035. 8 figs. Mollier.

ii. Blood and blood vessels of Cyclostomes, p. 1080-1089. 11 figs. Mollier.

iii. Origin of blood and embryonal blood vessels of Selachians, p. 1090-1124. 25 pls. Rückert.

iv. Development of heart and blood-vessels in Teleosts, p. 1125-1153. 34 figs. Mollier.

v. Blood and blood-vessel formation in the Ganoids, p. 1154-1164. 12 figs. Mollier.

Rütimeyer, Carl Ludwig. Ueber Encheiziphius, ein neues Cetaceengenus. Verh. Naturf. Ges. Basel, 1857, 1, 555-567.

Add. 1857.1

Describes *E. teretirostris* from Pliocene of Montpellier, France, presumably a mammal. Redescribed (Beneden, P. J. van, 1870.2) as *Brachyrhynchus*, a synonym of *Istiophorus*.

Rund, Gudrun. Om hudsanseorganene hos *Spinax niger* Bonaparte (On the dermal sense organ in *Spinax niger*) Nyt Mag. Nat. Kristiania, 1914, 52, 285-352. 11 figs. pl.

Add. 1914.1

Rundle, Edmund. Electric ray at Porthleven. Zoologist, 1885, 3. ser. 9, 33-34. Add. 1885.1

Ruschenberger, W. S. W. [1807-1895] Elements of herpetology and

of ichthyology. Philadelphia, 1856.
 illust. 8°. Add. 1856.1
 First edition, Philadelphia, 1845. 145 p.
 illust.

Russel, F. Explorations in the far
 north. Univ. Iowa Public., 1898,
 290 p. Add. 1898.1
 Fishes, p. 271-275.

Rutherford, — *Saprolegnia ferox*
 (on fish). Grevillea, 1880-81 (1880), 9,
 9-10. Add. 1880.1

Rutter, Cloudsley. Studies in the
 natural history of the Sacramento sal-
 mon. 17. Bienn. Rept. State Board
 Fish Comm. California, 1901-02 (1902),
 64-76. Add. 1902.1

See also Rutter, C., 1902.1

— Artificial propagation of salmon
 in the Sacramento river. 18. Bienn.
 Rept. State Board Fish Comm. Cali-
 fornia, 1903-04 (1904), 103-106.
 Add. 1904.1

Ruzhić, Dobroslav M. O znachaiu
Amphioxus lanceolatus — a za nauku
 razvica, i o stroiu chorda dorsalis i
 nervne sisteme kod Amfioksusa. (On
 the importance of *A. lanceolatus* for
 the study of development, and on the
 structure of the chorda dorsalis and

nervous system of *Amphioxus*). Ghas-
 nik Srpsk. Uchen. Drustva., Belgrade,
 1889, 70, 239-256. illust. 8°. Add. 1889.1

Ryder, John Adam [1852-1895] For
 account of his work with U. S. Fish
 Commission see Dean, B. 1895.1.

— Development of viviparous
 minnows (*Gambusia patruelis*). Science,
 1884, 3, 769. Add. 1884.1

— The protozoa and protophyta
 considered as the primary or indirect
 source of the food of fishes. Rept.
 U. S. Fish Comm. 1881 (1884), 9,
 755-770. Add. 1884.2

Rynberk, Gerard Abraham van. Di
 alcuni speciali fenomeni motori e
 d'inibizione nel pesce cane (*Scyllium*).
 Arch. Farmacol. Sper. Sci. Aff., 1904,
 3, 270-275. Add. 1904.1

— Ueber den durch Chromato-
 phoren bedingten Farbenwechsel der
 Tiere (sogenannte chromatische Haut-
 funktion). Ergebnisse Physiol., Wies-
 baden, 1906, 5. Jahrg., 2. Abth., 347-
 571. Add. 1906.1

Der Farbenwechsel der Fische, pt. vi, p. 511-
 552.

S

S. —. Fall of fish. Journ. Asiatic Soc. Bengal, 1834, **3**, 367.
Add. 1834.1

S., J. M. Force of the unicorn fish. Journ. Asiatic Soc. Bengal, 1835, **4**, 411.
Add. 1835.1
Vessel's bottom penetrated by swordfish.

Sabrazès, Jean, & Muratet, L. Trypanosome de l'anguille. Act. Soc. Linn. Bordeaux, 1902, **57** (n. s. 7), 124-128. — Centralb. Bakteriolog., Jena, **34** (Abth. 1), 332-333. Add. 1902.1

— Trypanosome de la torpille (*Torpedo marmorata* Risso). Bull. Institut. Pasteur, Paris, 1908, **6**, 667. — Centralb. Bakteriolog., Jena, 1908, **42** (Abth. 1), 496-497. (Ref.) Add. 1908.1
Abstracts of Sabrazès & Muratet, 1908.2.

Sachs, Carl. Aus den Llanos. Schilderung einer Naturwissenschaftlichen Reise nach Venezuela. Leipzig, 1879. Add. 1879.1

Discussion of breeding habits of *Gymnotus electricus* and of its electrical powers.

Sachs, E. T. A note on oral gestation in a freshwater fish of Biliton. Nature, 1881, **23**, 275. Add. 1881.1
Fish never identified.

Saint-Ange, Gaspar Joseph Martin. De l'appareil reproductif des animaux vertébrés. Mém. Acad. Sci. Paris, 1856, **14**, 1-232. 17 pls. Add. 1856.1
Carp, p. 120-132, pls. 12 & 13; dog-fish, p. 132-150, pl. 14; lamprey, p. 151-159, pl. 15; hag-fish, p. 159-165. pl. 16.

St. John, Spencer. Life in the forests of the far east (Borneo) 2 vols. London, 1844. Add. 1844.1

Vol. I: Trolling for sharks and "Tangiri" fish, p. 81; sharks in upper Sarawak river, p. 137; fishing with traps, p. 253; poisonous fish, p. 349-351. Vol. II: Musical fish, p. 276; fishing with tuba plant, p. 277.
A later edition, London, 1863.

Saint-Pierre, —, & Cavenne, — Rapport fait à la demande de M. le directeur général de l'intérieur à la Martinique . . . sur le mémoire de M. Artaud, pharmacien, intitulé: No-

tice pour servir à l'histoire naturelle du Goramy. Bull. Soc. Linn. Bordeaux, 1827, **2**, 188-191. Add. 1827.1

Saint-Savery, —. La pisciculture et les chemins de fer. La Pisciculture Pratique, 1899, **5**, no. 11, 194-197. Add. 1899.1

Salanone-Ipin, H. Etude sur un tétrodon vulnérant du Cambodge. Bordeaux, 1889. 42 p. pl. Add. 1889.1
A medical thesis.

Salter, John William [1820-1869] Description of the species of *Pterygotus*. (In Figures and descriptions illustrative of British organic remains. Monographs, vol. 1, pt. 1. Geological Survey Great Britain & Ireland, London, 1859, 37-105). Add. 1859.1

— Iron ores of Great Britain. Mem. Geol. Soc., 1861. Add. 1861.1
Refers a fin spine from coal measures of south Wales to "*Byssacanthus?*", p. 224.

Salter, J. W., & Huxley, T. H. See **Huxley & Salter**.

Salter, Thomas Frederick. The angler's guide, being a plain and complete practical treatise on the art of angling. . . . London, 1841. xii, 388 p. 8°. Add. 1841.1

This is the ninth edition. Others are: London, 1814, 1815, 1816, 1823, 1830, 1833 (8th ed. with the author's last corrections and additions, and 88 cuts).

— The troller's guide, a new and complete practical treatise on the art of trolling or fishing for jack or pike. Illustrated with numerous cuts of hooks, baits, tackle, etc. To which is added the best method of baiting and laying lines for large eels. London, 1841. iv, 83 p. 12°. Add. 1841.2

Previous editions are: London, 1820, 1830 (with the author's last additions and 28 cuts).

Salvin, Fr. H., & Freeman, Gage Earle. See **Freeman & Salvin**.

Samuels, Mark. Amateur aquarist. New York, 1894. 114 p. illust. 12°. Add. 1894.1

Sandager, F. S. List of fishes found round the Mokohinou islands; their spawning times; and observations regarding some of their species. Trans. Proc. New Zealand Instit., 1887 (1888), 20, 127-133. Add. 1888.1

Sande, G. A. J. van der. Ethnography and anthropology (In Résultats de l'Expédition Scientifique Néerlandaise à la Nouvelle-Guinée en 1903, sous les auspices de Arthur Wichmann. vol. iii. Leiden, 1907). Add. 1907.1

Fishing, p. 160-170. 7 figs. [Fully authoritative]

Sander, Heinrich. Gesammelte kleine Schriften, nach dessen Tode herausgegeben. Dessau & Leipzig, 2 vols. 1784-85. 8°. Add. 1784.1

Contains accounts of various German fishes.

Sanderson, J. Burdon [1828-1905] Memoirs of the physiology of . . . the electrical organ. (In vol. I of his Translations of foreign biological memoirs. Oxford, 1887. 653 p.) Add. 1887.1

Translations of articles by Biedermann and Du Bois-Reymond.

Sanfelice, F. Intorno all' appendice digitiforme (glandola sopranale) dei Selaci. — Ricerche istologiche ed embriologiche. Boll. Soc. Nat. Napoli, 1889, an. 3, fasc. 1, 1-23. 3 pls. Add. 1889.1

To replace Sanfelice, F. 1889.1.

Santa Cruz, Alonso de. El yslario general de todas las yslas del mundo, . . . etc. La quarta parte [circa 1541]. Edited by Franz R. von Wieser, under the title of "Die Karten von Amerika in dem Islario General des Alonso de Santa Cruz." Innsbruck, 1908. 59 p. maps. fol. Add. 1908.1

Numerous kinds of fishes found near Santo Domingo are mentioned by their vernacular names, pp. 16, 17.

Sarasin, C. F. Ueber einen Lederigel aus dem Hafen von Trincomali (Ceylon) und seinen Giftapparat. Zool. Anz., 1886, 9, 80-82. Add. 1886.1

Fish commensal with an echinus.

Sargent, Porter Edward. An apparatus in the central nervous system of vertebrates for the transmission of motor reflexes arising from motor stimuli. Biol. Bull. Boston, 1901, 2, 341-342. Add. 1901.1

Amia studied.

Saulcy, Ernest de. [Note on the acclimation of the gourami] Rev. Mag. Zool., 1861, 2. ser. 13, 430-431. Add. 1861.1

Sauri, l'Abbé — Histoire naturelle du globe, ou géographie physique, etc. 2 vols. Paris, 1778. 12°. Add. 1778.1

Volume II contains accounts of some fossil fishes. A German version is entitled:

— Natürliche Geschichte des Erdbodens darinnen von der Naturgeschichte der Erdkugel, . . . etc. 2 vols. Nürnberg, 1779-1780. 398 & 382 p. 8°. Add. 1779.1

Sauvage, Henri Emile [1844 —] Les poissons fossiles. (In Bibliothèque des sciences naturelles. Zoologie. Paris, 1869. vi, 31 p. pl. 8°.) Add. 1869.1

Reprinted with a preface and title page, from D'Orbigny's "Dictionnaire universel d'histoire naturelle."

— Recherches sur les poissons fossiles des terrains Crétacés de la Sarthe. Ann. Sci. Géol., 1870, 2, art. 7, 1-44. — Biblioth. l'Ecole Haut. Etude., 1872, 5, no. 9. 8°. Add. 1870.1

— Etude sur les poissons et les reptiles des terrains crétacés et jurassique supérieurs de l'Yonne. Bull. Soc. Sci. Nat. Yonne, 1879, 33 47-48. 8 pls. Add. 1879.1

Uranoplosus, p. 47, and *Cosmodus*, p. 48, new genera.

— Note sur les Cyprinodons du groupe du *C. calaritanus*. (In Révoil, G. Faune et flore des pays Comalis (Afrique orientale). Paris, 1882, pt. 5. 12 p. 3 pls. 8°.) Add. 1882.1

— La grande pêche (les poissons). Biblioth. Instruct., Paris, 1883. 314 p. illust. 8°. Add. 1883.1

— Description de deux espèces nouvelles de poissons du terrain Kimmeridgien du Cap de la Hève. Bull. Soc. Geol. Normandie, Havre, 1893, 14, 7 p. 2 pls. Add. 1893.1

Describes *Lepidotus lennieri* and *Pachycormus insignis* from Jurassic near Le Havre, France.

— Note sur un ganoïde de genre nouveau du Lias de Vassy (Yonne). Bull. Soc. Sci. Hist. Nat. Yonne, 1894, 48, 3 p. pl. Add. 1894.1

Prosauropsis, new genus; type, *Pachycormus* (?) *elongatus* Sauvage.

Sauvage, H. E.

— [Review of Bashford Dean on the origin of paired limbs of vertebrates] *Rev. Crit. Paléozool.*, 1903, 7, 75–80. Add. 1903.1

See Dean, B., 1902.2.

— [Review of C. R. Eastman's translation of Carl A. Zittel's *Palæontology*] *Rev. Crit. Paléozool.*, 1903, 7, 75. Add. 1903.2

See Eastman, C. R., 1902.10.

Sauvages, —. *De venenatis Gallie animalibus.* Dissert. Med. Rothomagensi Academia, 1758. Laura donata. Montpellier 1764. Add. 1764.1
Poisonous fishes, p. 6.

Savchenko, P. Poisoning by fish [Text in Russian] *Med. Pribov. K. Morsk. Sborniku*, St. Petersburg, 1882 (Sept.), 55–61. Add. 1882.1

Savigny, Marie Jules César Lelorgne de. *Histoire naturelle des Dorades de la Chine, avec des figures (48 pl.) gravées, par F. N. Martinet; accompagnée d'observations et d'anecdotes relatives aux usages, aux mœurs et au gouvernement de cet empire.* Paris, 1780. 24 p. 48 pls. fol. Add. 1780.1

See also, (in vol. II, p. 394) Sauvigny, E. L. B. de, 1780.1; and Martinet, F. N. Add. 1780.1.

Scammon, R. E. The development of the pancreas in selachians. *Anat. Rec.* 1914, 8, 132–133. Add. 1914.1

Schäfer, E. A. Text-book of physiology. 2 vols. London, 1898–1900. Add. 1898.1

Numerous references to fishes.

Schäme, P. *Tetrodon cutcutia*, Kugelfisch. *Wochenschr. Aquar.-Terrar.* Kunde, 1907, 4, 533. Add. 1907.1

Schaer, E. *Arzneipflanzen als Fischgifte.* Festgabe Deutschen Apothekervereins, Strassburg, 1897. 65 p. 8°. Add. 1897.1

— Ueber saponinhaltige Fischpflanzen. *Pharm. Zeitg.*, Berlin, 1901, 46, 788. Add. 1901.1

Schafhäutl, K. E. F. von [1803–1890] *Süd-Bayerns Lethæa Geognostica.* Der Kressenberg und die südlich von ihm gelegenen Hochalpen geognostisch betrachtet in ihren Petrefacten. Leipzig, 1863. xvi, 487 p. 98 pls. illust. map. Add. 1863.1

Describes *Diaphyodus ovalis*, n. g. et n. sp., (Labrodon) from Eocene of Bavaria, p. 246.

Schaper, Alfred. Die frühesten Differenzirungsvorgänge im Centralnervensystem. *Arch. Entwickl. Organismen*, Leipsic, 1897, 5, 81–132.

Add. 1897.1

Refers to cyclostomes, sharks, and teleosts.

Schauinsland, H. Die Entwicklung der Wirbelsäule nebst Rippen und Brustbein. (In Hertwig, O. *Handbuch Entwicklungslehre der Wirbeltiere*, Jena, 1906, Bd. 3, pt. 2.) Add. 1905.1

This monograph was published in 1905. For fishes see p. 167–235. 37 figs.

Scherzer, Karl von. The cultivation of the sea. *Bull. U. S. Fish Comm.* 1884, 4, 348–350. Add. 1884.1

Notes on the sea-fisheries of Great Britain, Norway, France, Italy, Germany, Austria-Hungary and the United States.

Schieffelin, W. H. Unexplained variations in the yield of oil from cod livers. *Bull. U. S. Fish Comm.*, 1883, 3, 431. Add. 1883.1

Schiemenz, Paulus. Ueber die Zeesenfischerei im Stralsunder Revier. *Abh. Deutsch. Seefischerei Ver.*, Berlin, 1898, 3, 25–103. 2 pls. Add. 1898.1

— Lebensdauer unbefruchteter (Forellen-) Eier. *Allgem. Fischerei Zeitg.*, 1901, 26, 232. Add. 1901.1

— Betrachtungen über die natürliche Ernährung unserer Teichfische. *Deutsch. Fischerei Zeitg.*, Stettin, 1907, no. 19–24. Add. 1907.1

— Vergleichung der Fruchtbarkeit von Seen und Flüssen (In *Aus Deutscher Fischerei*, Neudamm, 1911) Add. 1911.1

Schiller, K., Schorler, B. & Thallwitz, J. See **Schorler, Thallwitz & Schiller.**

Schilling, G. W. Bemerkungen an dem Zitter-Aal. *Berlin. Samml.*, 1769–70, 2, 362–366. Add. 1769.1

— De torpedine pisce. *Ultrajecti*, 1770. 8°. Add. 1770.1

— Sur les phénomènes de l'anguille tremblante. *Nouv. Mém. Acad. Sci. Berlin*, 1770, 26, 68. Add. 1770.2

Schimkewitsch, W. *Lehrbuch der vergleichende Anatomie der Wirbeltiere.* Stuttgart, 1910. 649 p. 635 figs. Add. 1910.1

Fishes extensively treated.

— Les phénomènes de méthorise chez les vertébrés. 9. Congr. Internat. Zool., Monaco, 1913 (1914), 371–378.

Add. 1914.1

Fishes, p. 374–376.

Schinz, Heinrich R. Das Thierreich, etc. 4 vols. Stuttgart, 1821–25. gr. 8°.

Add. 1821.1

Vol. ii, Fische.

Translation, with emendations, of Cuvier's "Règne animal."

— Die Fische unserer Gewässer. (In An die Züricher Jugend, etc. Naturf. Gesell. Zürich, 1799–1866, Stück 50, (1848)).

Add. 1848.1

Schlegel, H., & Temminck, C. J. See **Temminck & Schlegel**.

Schluesser, Guilielmus. De Petro-myzontum et anguillarum sexu. Dissertatio inauguralis, &c. Dorpati Livonorum, 1848. 40 p. pl. 8°. Add. 1848.1

Schmalhausen, J. Zur Morphologie der unpaaren Flossen. III. Entwicklung des Skelettes der hypochordalen Caudalis von Pristiurus und der unpaaren Flossen von Acipenser. Zeitschr. Wiss. Zool., 1913, **107**, 742–759. pl. Add. 1913.1

For parts I and II, see Schmalhausen, J., 1912.1.

Schmeltz, J. D. E. Ein Beitrag zur Kunde der Südsee-Völker. Ethnographische Abtheilung. Ethnog.-Anthrop. Abth. Museum Godeffroy Hamburg, 1881, 1–500.

Add. 1881.1

Fishing apparatus described, hooks, spears, nets, etc.

Schmeltz, J. D. E., & Clercq, F. S. A. de. See **Clercq & Schmeltz**.

Schmey, M. Ueber Neubildungen bei Fischen. Frankfurter Zeitschr. Path., 1911, **6**, 230–252. Add. 1911.1

Clupeiden, Salmoniden, Cypriniden, Esociden, Siluriden, Apodiden, Perciden und Pleuronectiden.

Schmid, F. Chr. Ueber die Leber und das Pfortadersystem der Fische. Inaug. Dissert., Breslau, 1882. 39 p.

Add. 1882.1

Schmidt, — Die Barben-Seuche. (Myxosporidiose Roillet) Wochenschr. Thierh. Viehzucht, München, 1899, **43**, 237–240.

Add. 1899.1

Schmidt, Edouard Oscar [1823–1886] Die Entwicklung der vergleichende Anatomie. Jena, 1855. 144 p. 8°.

Add. 1855.1

Schmidt, F. A. Petrefacten-Buch, oder allgemeine und besondere Versteinerungskunde mit Berücksichtigung der Lagerungsverhältnisse besonders in Deutschland. Stuttgart, 1846. pls. & figs.

Add. 1846.1

Fossil fish, plate 28.

Schmidt, F. T. Om Fjarsingens Stik og Giftredskaber. Nord. Med. Arkiv., 1875, **6**, no. 2, 1–20 pl.

Add. 1875.1

Poison glands of Trachinus.

Schmidt, [E.?] J. Messungen an Mittelmeerglasaalen. Der Fischerbote 1911. 3. Jahrg., 139–140. Add. 1911.1

Schmidt, Joh. Sur la reproduction et les lieux de ponte de l'anguille vulgaire. Bull. Soc. Cent. Aquic. Pêche, Paris, 1912, **24**, nos. 9–10. Add. 1912.1

— Alens fortplantning och lekplatser. Svensk. Fiskeri Tidskrift, 1913. 22. årg., 17–28. Add. 1913.1

Schmidt, Nikolai. Zur Frage über die Natur des Fischgiftes und dessen Wirkung auf den menschlichen und tierischen Organismus. Verh. 10. Internat. Med. Congr., Berlin, 1891, **2**, 4. Abth., 43–57. Add. 1891.1

Schmidt, Peter. Einige Beobachtungen über die Seefischerei in Japan. Mitth. Deutsch. Seefischerei-Ver., Berlin, 1903, no. 2, 1–31. 22 figs.

Add. 1903.1

Schmidt, P. J. Sur les conditions physico-géographiques et la faune de la mer du Japon et de la mer d'Okhotsk. Prelim. Rept. Bull. Imp. Russ. Geog. Soc., St. Petersburg, 1902 (1903), **38**, pt. 5, 503–532. Add. 1903.1

Text in Russian, lists in English.

Schmidt-Nielsen, Sigval. Ueber Pökelversuche mit Fischfleisch. Archiv Math. Naturvid., 1901, **23**, no. 5. 8 p. 8°.

Add. 1901.1

Schmiedeberg, O. Ueber die Nukleinsäure aus der Lachsmilch. Arch. Exper. Pathol. Pharm., 1899–1900, **43**, 57–83. Add. 1899.1

Schmitt, J. Monographie de l'isle d'Anticosti. Paris, 1904. 367 p.

Add. 1904.1

Poissons, p. 282–287.

Schmitter, A. Fischfang und Fischereigeräte der Vorzeit. Fischereizeitung, 1911, **14**, no. 17, 281–283.

Add. 1911.1

Schnee, S. Ist Hai- oder Schildkrötenleber giftig? Zool. Garten, 1902, 43, 330. Add. 1902.1

— Der Lachsfang im Norden der Vereinigten Staaten. Zool. Garten, 1902, 43, 203-204. Add. 1902.2

Schneider, G. Fische des Flusses Pernau. Korrespbl. Naturf. Ver. Riga, 1911, 54, 57. Add. 1911.1

Kurze Bemerkungen über die Einwirkung von Hafenanlagen und Abwässern auf die Fischfauna im Unterlauf des Pernau.

Schneider, Guido. Ueber das Vorkommen von Larven des Bandwurms, *Bothriotænia proboscidea* Batsch, im Magen und Darm von Ostseeheringen (*Clupea harengus membras* L.) Zool. Centralb., Leipzig, 1902, 9, 198-199. — Arch. Naturg., Berlin, 1905, 64. Jahrg. (2. abth.) 74. Add. 1902.1

See also Schneider, G., 1902.6.

— Die Ichthyotænen des finnischen Meerbusens. Festschr. Palmén. Abstract in Zool. Centralb., Leipzig, 1905, 12, 838-839. Add. 1905.1

For original paper, see Schneider, G., 1905.5.

— Ueber die in den Fischen des finnischen Meerbusens vorkommenden Endoparasiten. Arch. Naturg., Berlin, 1905, 64. Jahrg. (2. vol.), 27. Add. 1905.2

Abstract of Schneider, G., 1900.3. iii.

Schneider, Gustav. Fischerei mit Tuba auf Sumatra, nebst Bemerkungen über Malayische Fischerei. Zeitschr. Fischerei, 1906, 13, 1-23. 6 figs. Add. 1906.1

Schneider, Johann Gottlob. Von Oppians und Aelians Verdienste um die Naturgeschichte. Allerneuste Manichfalt., 1783. 2, 392. Add. 1783.1

— Anatomische beyträge zur naturgeschichte seiniger einheimischen vierfüßigen Thiere, Vögel, Schlangen und Fische. Leipzig. Magaz., 1787, 194-227. Add. 1787.1

Schneider, Konrad. Der Fischer in der antiken Litteratur. Jahresber. K. Kaiser-Wilhelms-Gymnasium Aachen, 1891-92 (1892), i-x. Add. 1892.1

To replace Schneider, K. 1892.1.

Schneider, — & Bassompierre, —. See **Bassompierre & Schneider.**

Schnitzlein, —. Der Glanz der Fischschuppen. Pharmac. Centralb., 1837, 8, 398. Add. 1837.1

Abstract of Schnitzlein, 1836.1.

Schoenlein, K. Beobachtungen und Untersuchungen über den Schlag von Torpedo. Zweite Mittheilung. Zeitschr. Biol., 1896, 33 (n.F. 15), 408-461. 2 pls. Add. 1896.1

Schoepf, Joh. David [1752-1800] For biographical notice, see that by E. Kremers, in "D. I. Schoepf . . . Materia medica Americana potissimum regni vegetabilis." Erlangæ, 1787.

Reprint in Lloyd, J. U., & C. G. Bulletin of the Lloyd Library of Botany. 1903, no. 6, xviii, 170 p.

— Vom Pfeilfische. *Esox belone* L. Berlin. Samml., 1776, 8, 229.

Add. 1776.1

Schoett, Harald. Einige Bemerkungen über den Bau von *Epibdella hippoglossi* O. F. Müller. (In Zool. Stud. Festschr. Wilhelm Lilljeborg, Upsala, 1896, 253-265. 16 figs.)

Add. 1896.1

Schofield, Norman Bishop. Notes on an investigation of the movement and rate of growth of the quinnat salmon fry in the Sacramento river. 15. Bienn. Rept. State Board Fish Comm. California, 1897-98 (1898), 66-71.

Add. 1898.1

— Notes on the movements of the young of the steelhead trout (*Salmo gairdneri*, Richardson) in Marin county streams. 15. Bienn. Rept. State Board Fish Comm. California, 1897-98 (1898), 63-65.

Add. 1898.2

— A report on the planting of quinnat salmon fry in the short coast streams of Marin county. 15. Bienn. Rept. State Board Fish Comm. California, 1897-98 (1898), 63-65.

Add. 1898.3

Schomburgk, [Moritz] Richard [1811-1890] Reisen in Britisch-Guiana in 1840-1844 . . . Nebst einer Fauna und Flora Guiana's nach Vorlagen von J. Müller, Ehrenberg, Erichson, Klotsch, Troschel, Cabanis und anderen. 3 pts. Leipzig, 1847-48. 8°.

Add. 1847.1

I. Fauna. Fische, bearbeitet von J. Müller and F. H. Troschel.

This work, cited under Schomburgk, (Sir) Robert Hermann, 1847.1, should properly be credited to this author.

Schorler, B., Thallwitz, J. & Schiller, K. Pflanzen und Tierwelt des Moritzburger Grossteichen bei

Dresden. Ann. Biol. Lacustre., 1906, 1, 193-310. Map & 3 tables.

Add. 1906.1

Magenuntersuchungen von Fischen, insbesondere Barschen.

Schotte, W. [Review of Deml, Josef, Bayerische Fischerei-Regesten aus dem Ammergebiet.] Arch. Fischerei Gesch., 1913, Heft 1, 205-207.

Add. 1913.1

Schousboe, P. Jagttagelser over taenderne hos nogle fiskearten. (*Sparus aurata*; *S. sargus*) Skriv. Naturhist. Selsk. Kiøbenhavn, 1797, 4, pt. 1, 180-211.

Add. 1797.1

Schrank, Franz von Paula. Fauna Boica: Durchgedachte Geschichte der in Bayern einheimischen und zahmen Thiere. 1 vol. [in 2 parts] Nürnberg, 1798. gr. 8°.

Add. 1798.1

Schreiber, J. Ueber Fischvergiftung. Berlin. Klin. Wochenschr., 1884, 21, 161; 183.

Add. 1884.1

Schroeder, A.E. von. The encysted stage of a Distomum in the muscles of a sturgeon [Text in Russian] Vrach, St. Petersburg, 1895, 16, 1200-1201. Abstract in Centralb. Bakteriöl., Jena, 1896, 19 (Abth. 1), 462.

Add. 1895.1

— Finnen von *Bothriocephalus latus* aus Barschen in Dorpat [Text in Russian]. Sovrem. Klin. Terop., Karlov, 1896, 3. Abstract in Centralb. Bakteriöl., Jena, 1896, 20 (Abth. 1), 621.

Add. 1896.1

Schroeder, Olaw. Eine neue Myxosporidienart aus den Kiemen von *Accrina cernua*, (*Henneguya acerinae*, n. sp.) Arch. Protistenk., Jena, 1906, 7, 186-196. pl. Abstracts in Bull. Instit. Pasteur, Paris, 1906, 4, 438-439. — Zool. Centralb., Leipzig, 1906, 13, 589-590.

Add. 1906.1

Schroeder, Olaw, & Schuberg, August. See **Schuberg & Schroeder.**

Schröder, W. *Eleotris lebretonis* Stud. Wochenschr. Aquar.-Terrar. Kunde, 1906, 3. Jahrg., 415-417. fig.

Add. 1906.1

— *Hemichromis fasciatus* Ptrs., ein neuer Aquarienfisch. Wochenschr. Aquar.-Terrar. Kunde, 1906, 3. Jahrg., 331-332. fig.

Add. 1906.2

Schröter, Johann Samuel [1735-1808] Abhandlungen über verschie-

dene Gegenstände der Naturgeschichte. 2 vols. Halle, 1776 & 1777. 488 & 462. 8 pls. gr. 8°.

Add. 1776.1

Schuberg, August, & Schroeder, Olaw. Myxosporidien aus den Nervensystem und der Haut der Bachforelle. Bull. Instit. Pasteur, Paris, 1905, 3, 965. — Centralb. Bakteriöl., Jena, 1906, 38 (vol. 1), (Ref.), 215. — Zool. Centralb. Leipzig, 1906, 13, 588-589. — Journ. Roy. Micros. Soc., London, 1907, 54.

Add. 1905.1

See also, Schuberg & Schroeder, 1905.1.

Schulenberg, W. von. Fischereiliche Stadtwappen. Mitth. Fischerei Ver. Prov. Brandenburg, 1911, 2, Hefte 19-22, 313-318. 11 figs.

Add. 1911.1

Schultze, Carl August Sigmund [1795-1877] Ueber die ersten Spuren des Knochensystems und die Entwicklung der Wirbelsäule in den Thieren. Deutsches Archiv. Physiol. (Meckel), 1818, 4. Bd., 329-402. pl.

Add. 1818.1

First figure of tail structure of Mola.

German version of Schultze, C. A. S., 1818.1.

Schultze, Johann. Ein mittelalterlicher Fischkenner (name unknown) Arch. Fischereigesch., 1914, Heft 2, 133-137.

Add. 1914.1

Schultze, Martin. Frühneolithische Jagd- und Fischereigeräte der Provinz Posen. Arch. Fischereigesch., 1914, Heft 2, 109-132.

Add. 1914.1

Schultze, Max. Die Entwicklungsgeschichte von *Petromyzon planeri*. Naturw. Verh. Ges. Wiss. Harlem, 1856, 12, 1-49. 8 pls.

Add. 1856.1

Schulze, —. Relatio de migratione salmonum in Albi. Dresd. Magaz., 1765, 2, 234. Abstract in Comment. Lips., 13, 468.

Add. 1765.1

Schulze, Franz Eilhard. Epithel und Drüsenzellen. Arch. Mikr. Anat., 1867, 3, 137-203. 7 pls.

Add. 1867.1

I. Die Oberhaut der Fische und Amphibien, p. 138-166.

i. Becherzellen der Fisch-Oberhaut, p. 144-154.

ii. Die Kolben in der Fisch-Oberhaut, p. 154-161.

iii. Die Körnerzellen in der Oberhaut der Neunaugen, p. 162-164.

iv. Die Verästelten der Fisch-Oberhaut, p. 165-166.

II. Das Epithel und die Schlauchdrüsenzellen des Darmcanales aller Wirbelthierclassen, p. 169-192.

— Ueber die Lebensweise von *Protopterus annectens*. Sitzber. Ges. Naturf. Freunde Berlin, 1889, 127.

Add. 1889.1

Schumacher, S. von. Ueber elastische Fasern im Herzen und in der Aorta der Axolotls und der Forelle. *Centralb. Physiol.*, 1898, **12**, 102.

Add. 1898.1

(**Schweser, Chr. H.**) Germani Philoparchi kluger Forst- und Jagdbeamte oder Anleitung, wie die Forst-Jagd- und Wildbahngerechtsame aufs beste zu beobachten. Wobey zur Kenntniss des Wildes, der Vogelweide, der Fischerey Anweisung gegeben wird. Nürnberg, 1774. 5 pls. 4°. Add. 1774.1

Fishing, pp. 504-559.

Sclater, Philip Lutley. On collecting and preserving specimens of fishes and reptiles. *Nat. Hist. Review*, 1862, 233-234.

Add. 1862.1

— Use of the remora in fishing. *Nature*, 1889, **39**, 295.

Add. 1889.1

Scofone, L. Sulla presenza nel sangue di sostanze tossiche iniettate nell'organismo. Ricerche su i sieri di anguilla e di tinca. *Giorn. Roy. Accad. Med. Torino*, 1904, **57**, 618.

Add. 1904.1

Scott, — Note on the occurrence of cancer in fish. *Trans. Proc. New Zealand Inst. Wellington*, 1892, **24**, ('n. s. 7), 201. pl.

Add. 1892.1

Scott, Andrew. On copepods living in the nostrils of fishes. *Ann. Soc. Nat. Hist., Edinburg*, 1900, 153-155.

Add. 1900.1

— On the fish parasites, *Lepeophtheirus* and *Lernæa*. *Rept. Lancashire Sea-Fisheries Labor., Liverpool*, 1900, 63-115. 5 pls. — *Proc. Trans. Liverpool Biol. Soc.*, 1900-01 (1901), **15**, 188-241. 5 pls.

Add. 1900.2

Scott, A., & Herdman, W. A. See **Herdman & Scott.**

Scott, George G. The relation of aquatic animals to the water in which they live. *Bull. N. Y. Zool. Soc.*, 1914, **17**, 1090-1093.

Add. 1914.1

Original of Scott, G. G., 1914.2

Scott, Thomas. Notes on interesting fishes. 6. *Ann. Rept. Fishery Board Scotland*, 1888, 264-265.

Add. 1888.1

— On the distribution of pelagic invertebrate fauna of the Firth of Forth and its vicinity during the seven years from 1889-1895. 16. *Ann. Rept. Fish-*

ery Board Scotland, 1898, 153-210. 4 pls.

Add. 1898.1

Pelagic fish-eggs, p. 203-207.

— Notes on some crustacean parasites of fishes. 18. *Ann. Rept. Fishery Board Scotland, Glasgow*, 1900, pt. 3, 120-153. 3 pls.

Add. 1900.1

— The marine and freshwater fishes (In *Handbook on the fauna, flora and geology of the Clyde area prepared for the meetings. Brit. Assoc. Adv. Sci., Glasgow*, 1901, 173-180.)

Add. 1901.1

Scouler, John. [On various fishes noted at Glasgow] *Mag. Nat. Hist.*, 1833, **6**, 529-530.

Add. 1833.1

Scudder, Charles W., & Smiley, Charles W. See **Smiley & Scudder.**

Scupin, E. Etwas über Anabiose (Wiederaufleben) bei eingefrorenen Wassertieren. *Wochenschr. Aquar.-Terrar. Kunde*, 1906, **3. Jahrg.**, 333-336.

Add. 1906.1

Seal, William P. An inquiry as to the proper care of living things held for popular amusement and instruction or for purposes of biological research. *Bull. U. S. Fish Comm.* 1887 (1889), **7**, 285-287. 2 pls.

Add. 1889.1

— On the desirability of the establishment of great public aquaria in the United States. *Trans. Amer. Fisheries Soc.*, 1890, 20-26.

Add. 1890.1

Seale, Alvin. Poisonous fishes of the Philippine islands. *Bull. Philippine Bur. Health*, 1912, 1-14. 4 pls.

Add. 1912.1

— Preservation of commercial fishery products in the tropics. *Philippine Journ. Sci.*, 1914, sec. D, **9**, 3.

Add. 1914.1

Sebillot, Paul. Le folk-lore des pêcheurs. Paris, 1901.

Add. 1901.1

Reviewed by W. Bugiel. *Mittheil. Anthropol. Gesellsch. Wien*, 1902, **32**, 415.

Sedgwick, Adam (geologist) [1854-1913] On the geological relations and internal structure of the magnesian limestone and the lower portions of the New Red Sandstone series, etc. *Trans. Geol. Soc. London*, 1835, 2. ser. **3**, 37-124.

Add. 1835.1

Fossil fish, p. 116-118, pls. 8-11. Records *Palæothrissum magnum*, *P. macrocephalum* and *P. elegans* from Marl-slate of Midderidge and East Thickey, Durham.

Sedgwick, Adam, & Murchison, R. I. On the structure and relations of the deposits contained between the primary rocks and the Oolitic series in the north of Scotland. Trans. Geol. Soc. London, 1835, 2. ser. **3**, 125-161. Add. 1835.1

Fossil fish of Caithness [Devonian] schist, p. 141-144, pls. 15-17. Three new species of *Dipterus*.

Seemann, Berthold. Viti: an account of a government mission to the Vitian or Fiji islands in the years 1860-1861. Cambridge, 1862. Add. 1862.1

Sharks in fresh-water, p. 148, 384; Fishing with juice of *Barringtonia speciosa* and *Derris uliginosa*, p. 339; with nets and spears, p. 384.

Seligmann, C. G. The Melanesians of British New Guinea. London, 1910. 766 p. 79 pls. & 50 text-figs. Add. 1910.1

Fish, avoidance of eating, 681; totems, 11-12; fishing charms, 178; nets, names for, 215; magic, 294; rights, 468; taboos, 576-577.

Seligo, Arthur. Ueber den Ursprung der Fischnahrung. Mitteil. Westpreuss. Fischerei Ver., 1905, **17**, no. 4, 52. Add. 1905.1

Sell, Joh. Jac. Prodomus de halecum captura Pomerania Rugiæque insula littoribus seculo XII-XIV. Stettin, 1797. Add. 1797.1

A translation appears under the following title:

— Ueber den starken Häringsfang an Pommerns und Rügens Küsten im 12. bis 13. Jahrh. Aus dem Lateinischen übersetzt von E. H. Zober. Stralsund, 1831. 8°. Add. 1831.1

Aus der Zeitschrift "Sundine."

Selys-Longchamps, — de. [Réponse à cette question]: Doit-on admettre avec Spallanzani que l'anguille (*Muræna anguilla* Lin.) ne se reproduit que dans la mer, etc.? Cong. Scient. France, Clermont-Ferrand, 1838 (1839), 6. sess., 44-45. Add. 1839.1

Semon, Richard. Die äussere Entwicklung des *Ceratodus forsteri* (In his Zoologische Forschungsreisen in Australien und dem malayischen Archipel, ausgeführt in den Jahren 1891-93, etc. Bd. 1, pt. iv., p. 29-50. 8 pls. Jena, 1893) Add. 1893.1

— Verbreitung Lebensverhältnisse und Fortpflanzung des *Ceratodus forsteri* (In his Zoologische Forschungsreisen in Australien und dem malayischen Archi-

pel. Bd. 1, pt. iii, p. 11-28. map. Jena, 1893) Add. 1893.2

Semper, Carl. Reisen im Archipel der Philippinen. Zweiter Theil, Wissenschaftliche Resultate; Erster Band, Holothurien. Leipzig, 1868. Add. 1868.1

Fierasfer commensal with Holothurians, p. 96.

— Das Urinogenital System der höheren Wirbelthiere erklärt durch das Plagiostomen. Centralb. Med. Wiss., 1874, no. 59, 329-334; 945-949. Add. 1874.1

— Die Stammesverwandschaft der Wirbelthiere und Wirbellosen. Arb. Inst. Würzburg, 1875, **2**, 25-76. 3 pls. Add. 1875.1

Homology, segmental organs of plagiostomes and annelids, p. 45.

— Beobachtungen aus den Aquarien des neuen Zoologischen Instituts. Arb. Zool-Zoot. Inst. Würzburg, 1895, **10**, 13-36. pl. Add. 1895.1

i. Ueber Farbenveränderungen einiger Fische, p. 13-19. pl.

ii. Einige Bemerkungen über die Labyrinthfische, p. 19-32. text-fig.

Sennenbogen, E. Sulla "malattia" delle anguille. Neptunia, Venezia, 1902, **18**, 135-138; 150-153; 159-163; 171-173. Add. 1902.1

Bacillary disease.

See also Sennebogen, E., 1902.1.

Serres, Pierre Marcel Toussaint de. De la découverte du *Notæus longicaudus*, poisson malacoptérygien, dans les terrains d'eau douce aneuthalassique d'Armissan près de Narbonne (Aude). Bull. Soc. Géol. France, 1858, 2. ser. **15**, 492-499. Add. 1858.1

See also Serres, P. M., 1858.1.

Setti, Ernesto. *Tristomum perugiæ* n. sp. sulle branchie del *Tetrapturus belone* Raf. Arch. Parasitol., Paris, 1898, **1**, 308-313. fig. Add. 1898.1

Sévertzov, Aleksyei N. Ein Beitrag zur Frage nach der Evolution der niederen Wirbeltiere: die Segmentierung des Schädels der Neunaugen (Text in Russian) Journ. Soc. Nat., (Zool.), Moscow, 1914, **2**, v-vi. Add. 1914.1

Sewall, H., & Langley, J. N. See Langley & Sewall.

Seymour, Edward. Trout-fishing in the Rangeley lakes (In Mayer, A. M., Sport with gun and rod, etc., p. 351-378. New York, 1883) Add. 1883.1

This is the full title for Anon. no. 284, iii.

Shak, Theodor Pavlovich. On the vagus nerve of *Anguilla vulgaris* (Text in Russian) Naturf. Ges. Warsaw, 1896, 3, 23 p. pl. 8°. Add. 1896.1

Sharp, John. The large-mouthed black bass in Utah. Bull. U. S. Fish Comm. 1897 (1898), 17, 363-368.

Add. 1898.1

Shelford, Victor E. Animal communities in temperate America as illustrated in the Chicago region: a study in animal ecology. Geog. Soc. Chicago, Bull. 5, 1913. xiii, 362 p. illust. Add. 1913.1

For numerous references to fishes, see his index.

— Suggestions as to indices of the suitability of bodies of water for fishes. Trans. Amer. Fisheries Soc., 1914, 27-32. Add. 1914.1

Sheppard, Thomas, & Drake, Henry C. See Drake & Sheppard.

Shimokoriyama, Seiichi. On some clupeoid fish from Fuzan, Corea (Text in Japanese) Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 1, 16-17.

Add. 1914.1

Shipley, Arthur Everett [1861-] Further reports on parasites found in connection with the pearl oyster fishery at Ceylon. Rept. Gov. Ceylon Pearl Oyster Fisheries, Gulf of Manaar, part 3. London, 1905.

Add. 1905.1

Parasites in fishes.

— Note on *Cystidicola farionis* Fischer. A threadworm parasitic in the swim bladder of a trout. Parasitology, Cambridge (England), 1908, 1, 190-192. Abstracts in Journ. Roy. Micr. Soc., London, 1909, 51. — Centralb. Bakteriolog., Jena, 1909, 140.

Add. 1908.1

— Pearls and parasites. London, 1908. 232 p. illust.

Add. 1908.2

British sea-fisheries, p. 42-72.

Shipley, A. E., & Hornell, J. Report on the Cestode and Nematode parasites from the marine fishes of Ceylon. (In Herdman, W. A., & others. Rept. Gov. Ceylon Pearl Oyster Fisheries. Gulf of Manaar, 1906, pt. 2, 3, & 5. 6 pls. 118 figs.)

Add. 1906.1

Shirley, J. A fish poison [*Stephania hirnandiaefolia*] Proc. Roy. Soc. Queensland, 1895, 11, 88-90.

Add. 1895.1

Shore, Th. W., & Jones, H. L. On the structure of the vertebrate liver. Journ. Physiol., 1889, 10, 408-428. 3 pls.

Add. 1889.1

Petromyzon, Scyllium, Raia, Muræna, and Pleuronectes used, p. 412-414. 2 figs.

Shufeldt, Robert Wilson. Zur Kenntniss der amerikanischen Sägebarsche. Natur und Haus, 1899, 7, 119-120. 2 figs.

Add. 1899.1

Sicard, Adrien. L'introduction à Marseille du poisson chinois macropode et sa reproduction. Rép. Trav. Soc. Statist. Marseille, 1872, 7. sér. 4 (34), 312-.

Add. 1872.1

— Etudes sur le poisson King-yu du Japon et son acclimatation à Marseille. Rép. Trav. Soc. Statist. Marseille, 1880 (1882), 8. sér. 5 (40), 213.

Add. 1882.1

Sieber-Schoumow, (Mme.) N. O. Contribution à l'étude des poissons venimeux; sur le *Bacillus piscicidus agilis*, microbe pathogène pour les poissons. Arch. Sci. Biol., St. Pétersburg, 1894-95, 3, 226-256. pl. — Pharm. Zeitschr. Russland, St. Petersburg, 1895, 34, 193; 209; 225; 241.

Add. 1894.1

See also Sieber, N., 1895.1.

— Poisonous fish (Text in Russian) Trudui Obsh. Russk. Vrach, St. Petersburg, 1894-95, 61, 123-146.

Add. 1894.2

Sieurin, P. G. Fiskodling i våra sjoar. [Bericht über die Einführung neuer Fischarten in Finnländischen Seen] Skog och Sjö, 1911, 4, 108-109.

Add. 1911.1

Sighorskii, S. Die Anatomie des Nervensystems von *Amphioxus lanceolatus* (Text in Russian) Sitzber. Naturf. Ges. Kazan, 1895, 28, vuip. 3. 15 p. pl. 8°.

Add. 1895.1

Silvestre, —. Extrait d'un mémoire sur la respiration des poissons, comparée à celle des autres animaux. Bull. Sci. Soc. Philomat., Paris, 1797, 1, 17-18.

Add. 1797.1

Simmonds, P. L. The animal food resources of different nations with mention of some of the special dainties of various people derived from the animal kingdom. London, 1885. xii, 461 p. 8°.

Add. 1885.1

Simsohn, J. S. Two cases of fish poisoning. Polyclin., Philad., 1887-88, 5, 111.

Add. 1887.1

Sinicyn, D. F. Beiträge zur Naturgeschichte der Trematoden. Die Distomen der Fische und Frösche der Umgebung von Warschau. Zool. Centralb., Leipzig, 1906, **13**, 681-689. — Centralb. Bakteriolog., Jena, 1907, **39** (Abth. 1), (Ref.), 667-670. — Journ. Roy. Micr. Soc. London, 1907, 46-47. Add. 1906.1

Abstracts and reviews of Sinicyn, D. F., 1905.1.

Sirelius, U. T. Ueber die Sperrfischerei bei den finnisch-ugrischen Völkern. Eine vergleichende ethnographische Untersuchung. Helsingfors, 1906. 485 p. 607 figs. 4°. Add. 1906.1

Review by Sigismund Bátky in Anz. Ethnogr. Abth. Ungar. Nat. Mus., 1910, 5. Jahrg., 154-156. 19 figs.

Sizov, A. The auditory labyrinth of cartilaginous fish (sturgeon, sterlet, and schiffa; *Acipenser ruthenus*, *A. sturio*, and *A. schiffa*) [Text in Russian] Sitzber. Naturf. Ges. Kazan, 1881, **9**, no. 3. Add. 1881.1

Skeat, W. W. Malay magic, being an introduction to the folk-lore and popular religion of the Malay peninsula. London, 1900. Add. 1900.1

Fishing myths and ceremonies, p. 306-317; fishing with the kite at Singapore, p. 485.

Skeat, W. W., & Blagden, C. O. Pagan races of the Malay peninsula. 2 vols. New York, 1906. illust. Add. 1906.1

Many notes on fish and fishing, particularly included in p. 200-223.

Skene Dhu [pseudon.] The mighty masheer, (*Barbus mosal*) and other fish, or hints to beginners on Indian fishing. 2 ed. Madras, 1906. 256 p. illust. Add. 1906.1

Sluiter, C. Ph. Ein merkwürdiger Fall von Mutualismus. Zool. Anz., 1888, **11**, 240-243. Add. 1888.1

Trachichthys (*Amphiprion*) *tunicatus* living in an actinian.

Slyke, D. D. van, & White, G. F. Digestion of protein in the stomach and intestine of the dogfish. Journ. Biol. Chem., 1911, **9**, 209-217. Add. 1911.1

Slyunin, N. V. On the poisonous fishes in the Mediterranean Sea. [Text in Russian] Med. Pribav. K. Morsk. Sborniku, St. Petersburg, 1892, **1**, 269-276. Add. 1892.1

Small, H. B. The animals of North America. 2. ser. Fresh-water fish. Montreal, 1865. Add. 1865.1

Smets, G. Notices paléontologiques. Ann. Soc. Sci. Bruxelles, 1886-1887. Mémoires, 190. Add. 1886.1

Records *Arius egertoni* (Dixon) from Eocene of Saint-Gilles, Belgium.

Smidt-Nissen, —. Fra dammene. Ferskvandsfiskeribladet, 1911, 218-219. Add. 1911.1

Blindness among the young of *Trutta iridea* and *Salmo fontinalis*.

Smiley, Charles W. A list of the published reports of the commissioners appointed by authority of the various states of the United States. Bull. U. S. Fish. Comm. 1883, **3**, 85-107. Add. 1883.1

— Notes on the edible qualities of German carp, and hints about cooking them. Bull. U. S. Fish Comm., 1883, **3**, 305-332. — 18. Ann. Rept. Comm. Inland Fisheries, Massachusetts 1883 (1884), 56-83. Add. 1883.2

— A statistical review of the production and distribution to public waters of young fish by the U. S. Fish Comm. from its organization in 1871 to the close of 1880. Rept. U. S. Fish Comm. 1881 (1884), **9**, 825-916. Add. 1884.1

Smiley, Charles W., & Scudder, Charles W. Chronological list of pamphlets, publications of the United States Fish Commission, from its organization in 1871 to January, 1885. Bull. U. S. Fish Comm., 1885, **5**, 41-48. Add. 1885.1

Smith, Colin. Shower of fishes in Argyleshire. Edinburgh New Phil. Journ., 1826, **1**, 186-187. Add. 1826.1

Smith, Eugene. The home aquarium and how to care for it. New York, 1902, 213 p. illust. Add. 1902.1

Fishes, p. 74-129.

Smith, Hugh McCormick [1865-] Report on inquiry respecting food fishes and fishing grounds. Rept. U. S. Fish Comm. 1898 (1899), cxxiii-cxvi. Add. 1899.1

— [Fishes of lake Mattamuskeet, North Carolina] Rept. U. S. Fish Comm. 1900 (1901), 133-134. Add. 1901.1

Smith, H. M.

— Breeding habits of the yellow catfish (*Ameiurus nebulosus*) Science, 1903, n. s. 17, 243-244. Add. 1903.1

— Marking of artificially hatched salmon. Pacific Fisherman, 1905, 3, 24-25. Add. 1905.1

— Note on a rare flying-fish (*Cypselurus lütkeni*). Science, 1905, n. s. 21, 746. Add. 1905.2

Second known specimen, from Beaufort, N. C.

— Promotion of fishery trade between the United States and Japan. Pacific Fisherman, 1905, 3, no. 10, 8. Add. 1905.3

— The sardine. Pacific Fisherman, 1905, 3, no. 1, 12-13. Add. 1905.4

— Case of epidemic carcinoma of the thyroid in fishes. Med. Ann., Washington, 1909, 3, 313. Add. 1909.1

— [Oral incubation in Apogon or Amia] Proc. 4. Internat. Fishery Congr. Washington. Bull. Bur. Fisheries, 1908 (1910), 28, pt. 2, 1069. Add. 1910.1

Refers to Philippine cheilodipterids.

— [The capture of a second specimen of *Rhinodon typicus* on the coast of Florida] Science, 1913, n. s. 38, 314. Add. 1913.1

— The mysterious life of the common eel. Nat. Geogr. Mag. 1913, 1140-1146. Add. 1913.2

— The story of the sturgeons (In Linthicum, J. C. Protection of our food fish) Congressional Rec., Washington, Oct. 17, 1913, 13-14). Add. 1913.3

— Commercial possibilities of the goosfish: a neglected food. Econ. Circ. no. 13, U. S. Bureau Fisheries, 1914. 5 p. Add. 1914.1

— Pacific policy of the Bureau of Fisheries. Pacific Fisherman, Seattle, 1914, 12, no. 7, 7. Add. 1914.2

— Report of the United States commissioner of fisheries for the fiscal year ending June 30, 1913. Rept. Comm. Fisheries, 1913 (1914). Add. 1914.3

Smith, H. M., Evermann, B. W., Cobb, J. N., & Kendall, W. C. The

fish and fisheries of the coastal waters of Florida. 54. Congress. Senate Document no. 100. 1897. 80 p. Add. 1897.1

Smith, R. Whitefish and trout in lake Michigan. Rept. State Fish Comm. Illinois, 1906-08 (1908), 25-29. Add. 1908.1

Smith, (Miss) Rosa, afterwards **Eigenmann** [1859—] Note on the occurrence of *Gasterosteus williamsoni* Grd. in an artesian well at San Bernardino, Cal. Proc. U. S. Nat. Mus., 1883 (1884), 6, 217. Add. 1884.1

— On *Tetraodon setosus*, a new species allied to *Tetraodon meleagris* Lacep. Bull. California Acad. Sci., 1886, 6, 155-156. Add. 1886.1

Smith, William Anderson. Notes on the sucker fishes, Liparis and Lepadogaster. Proc. Roy. Phys. Soc. Edinburgh, 1885-89 (1885), 9, 143-151. pl. with 10 figs. Add. 1885.1

Structure of sucker. Breeding habits. Parental care.

Smitt, Fredrik Adam [1839-1904] On *Trachypteridernas stjertfena*. Bio. Fören. Förhandl., 1888, 1, 17-21. Add. 1888.1

Caudal rays of *Trachypterus* and *Regalecus*.

— Bedrifves det bohuslänska sillfisket på det för landet fördelaktigaste sätt. Aftryck. Landtbruks. Akad. Handl. Tijds., 1895, 55-64. Add. 1895.1

Smyth, (Capt.) William Henry. Memoir descriptive of the resources, inhabitants and hydrography of Sicily and its islands, with a list of the principal fish, . . . that frequent the Sicilian coasts and waters. London, 1824. Add. 1824.1

List of fishes with Sicilian and English names, appendix — p. lxvi-lxxiii.

Snow, Francis Huntington. Bibliography of scientific publications by members of the University of Kansas. Kansas Univ. Quart., 1899, ser. A, 8, 137-174. Add. 1899.1

Contains list of palæontological papers by F. H. Snow and S. W. Williston.

Snyder, Ch. D. Locomotion in *Batrachoseps* with severed nerve cord. Biol. Bull., Woods Hole, 1904, 7, 280-288. Add. 1904.1

Sobotta, Johannes. Die Befruchtung des Eies von *Amphioxus lanceo-*

latus. Anat. Anz., 1895, 11, 129-137.
9 figs. Add. 1895.1

— Die Furchung des Wirbeltier-
eies. Ergebn. Anat. Entwickl., 1897,
493-593. 38 figs. Add. 1897.1

A general paper of much value.

Sölling, A. An improved and
practical method of packing fish for
transportation. Proc. 4. Intern. Fish.
Cong., Washington, 1908. Bull. Bur.
Fisheries 1908 (1910), 28, part 1, 295-
301. Add. 1910.1

Soemerring, —, & Noethig, —.
Dissertationes de decussatione nervorum
opticorum (In Ludwig, Chr. Fr. Scrip-
tores neurologici minores selecti, sive
opera minora ad anatomiam, physio-
logiam et pathologiam nervorum spec-
tantia. 4 vols. Leipsic, 1791-96, 1,
134. figs. 4°.) Add. 1791.1

Solger, Bernhard Friedrich (Chiasma
of optic nerves in Engraulis) Sitzb.
Naturf. Ges. Halle, 1877. 1 p.
Add. 1877.1

— Zur Kenntnis der Seitenorgane
der Knochenfische. Vorläufige Mit-
theilung. Centralb. Med. Wiss., 1877,
15, 657-658; 817-820. Add. 1877.2

— Ueber pigmentirte Zellen und
deren Centralmasse. Mittheil. Naturw.
Ver. Neuorpommern & Rügen, Greifs-
wald, 1890, 22, 1-34. pl. Add. 1890.1

Sollmann, T. The effects of a
series of poisons on adult and embryonic
Funduli. Amer. Journ. Physiol., 1906,
16, 1-46. Add. 1906.1

Solotnitzky, N. F. von. Der Zit-
terwels (*Malapterurus electricus*) und
sein Gefangenleben. Natur und Haus,
1899-1900, 8, 61-63. Add. 1900.1

Sonrel, L. The bottom of the sea,
translated and edited by Elihu Rich.
New York, 1870. xix, 402 p. illust.
Add. 1870.1

Fishes, p. 124-141; 207-223.

Sonsino, Prospero. Di un nuovo
trematode raccolto dal *Pagrus orphus*.
Anno preliminare, Atti Soc. Toscana
Sci. Nat., Proc. Verb., Pisa, 1890, 7,
172. — Arch. Ital. Biol., Turin, 1891,
15, 147-148. Add. 1890.1

— Di un nuovo Microcotyle rac-
colto dall *Umbrina cirrhosa*. Atti
Soc. Toscana Sci. Nat., Proc. Verb.,
Pisa, 1891, 7, 303-304. Add. 1891.1

Southwell, Thomas [1831-1909]
Thresher shark [*Alopias vulpes*] Zo-
ologist, 1906, 10, 398. Add. 1906.1

— Descriptions of nine new species
of cestode parasites, including two new
genera, from marine fishes of Ceylon.
Ceylon Mar. Biol. Repts., 1911, pt. 5,
216-225. Add. 1911.1

A number of marine fishes and their internal
parasites are listed.

— Further notes on the determina-
tion of the adult of the pearl-inducing
worm. Ceylon Mar. Biol. Repts., 1911,
pt. 5, 213-215. Add. 1911.2

Infection experiments on a number of marine
fishes.

— Specific fauna of the Paars,
with notes on the nature of the sea-
bottom. Ceylon Mar. Biol. Repts.,
1911, pt. 5, 200-204. Add. 1911.3

A number of fishes are named with their in-
ternal parasites.

— Notes on the fauna of the
Ceylon pearl banks. Ceylon Admin.
Repts., pt. iv. Education, Science, &
Art, Marine Biol., 1912-13 (1913),
E 32-E 49. Add. 1913.1

Fishes as hosts of internal parasites, with
notes on their stomach contents and breeding
conditions.

— Notes on the food of certain
marine fishes from Ceylon. Ceylon
Admin. Repts., iv, Education, Science,
& Art, Marine Biol., 1912-13 (1913),
49-52. Add. 1913.2

Spallanzani, Lazzaro [1729-1799]
For biographical data, see L'Abate
Spallanzani a Pavia. Mem. Soc. Ital.
Sci. Nat. Milan, 1901, 6, no. 3. 68 p.
port. illust. 4°. Un autógrafo del
Abate Spallanzani, por D. M. Jimenez
de la Espada. Ann. Real Soc. Españ.
Hist. Nat., Madrid, 1872, 1, 163-181.

— Vom Krampffische. Giorn.
d'Ital., 1764, 1, 47. — Hannöv. Mag.,
1771, 1054. Add. 1764.1

Title from Boehmer. Text probably in Ital-
ian.

Spencer, W. B. Through Larapinta
land; a narrative of the Horn Expedi-
tion to central Australia. Melbourne,
1896. 136 p. illust. 4°. Add. 1896.1

Presence of fish in the water-holes. No fish in
central Australia known to have taken on the
habit of Protopterus, the mud-fish.

— On the habits of *Ceratodus*, the
lungfish of Queensland. Nature, 1892,
45, 425. Add. 1892.1

An abstract of Spencer, W. B., 1892.1.

Spengel, Johann Wilhelm. Beitrag zur Kenntniss der Kiemen des Amphioxus. Zool. Jahrb., Anat. Abth., 1891, 257-296. 2 pls. 36 figs. Add. 1891.1

Spielmann, Jac. Reinb. Verzeichniss der Fische und Vögel, die in und an der Elbe sich aufhalten. Wittenberg. Wochenbl. 1779, 12, 277. Add. 1779.1

Splittgerber, A., & König, J. See **König & Splittgerber.**

Spofforth, J. L. A case of poisoning by eating part of a toad-fish. Australas. Med. Gaz., Sydney, 1886-87, 6, 266. Add. 1886.1

Srámek, A. Helminthen der an der zoologischen Station in Podiebrad (Böhmen) untersuchten Fische. Arch. Naturwiss. Landesdurchforsch. Böhmen, Prag, 1901, 11, 94-118, 21 figs. Abstracts in Zool. Centralb., Leipzig, 1902, 9, 451. *Ibid.*, 1905, 12, 172-173. — Arch. Naturg., Berlin, 1905, 64. Jahrg. (vol. 2), 27, 44. Add. 1901.1

Stabler, E. M., & Parker, G. H. See **Parker & Stabler.**

Stadler, Hermann. Geschichtlich-zoologische Studien über die Albertus Magnus Schrift "De animalibus." Mitteil. Ges. Med. Naturw., Hamburg, 1907. Add. 1907.1

— Vorbemerkungen zur neuen Ausgabe der Tiergeschichte des Albertus Magnus. Sitzber. K. Bayer. Akad., philos.-philol.-hist. Kl., München, 1912, Abth. I. 58 p. Add. 1912.1

— Zur Charakteristik der gangbarsten Ausgaben der Tiergeschichte des Albertus Magnus. Archiv. Ges. Naturw., Leipzig, 1912. Add. 1912.2

— Irrtümer des Albertus Magnus bei Benutzung des Aristoteles. Arch. Ges. Naturw., Leipzig, 1913. Add. 1913.1

Stafford, Joseph. Trematodes from Canadian fishes. Journ. Roy. Micr. Soc., London, 1904, 417. — Zool. Centralb., Leipzig, 1906, 13, 42-43. Add. 1904.1

Abstracts of Stafford, J., 1904.1.

— On the fauna of the Atlantic coast of Canada. Third report, — Gaspé, 1905-1906. Contrib. Canadian Biol. 1906-10 (1912), 45-67 (Suppl. Ann. Rept. Dept. Mar. Fisheries, Fisheries Branch) Add. 1912.1

Stahr, —. Aristoteles bei den Römern. Leipzig, 1834. Add. 1834.1

Stair, J. B. Old Samoa or flotsam and jetsam from the Pacific ocean. London, 1897. 296 p. ill. Add. 1897.1

Modes of fishing; noosing sharks, trolling for bonito, use of nets, etc. (said to be 100 different methods) p. 201-206.

Stannius, H. Handbuch der Anatomie der Wirbeltiere (In Siebold, C. T. E. von, & Stannius, F. H., Handbuch der Zootomie. 2 vols. Berlin, 1854. 279 p. 8°.) Add. 1854.1
Book 1, Die Fische.

Stansch, K. Neuere Fische, ihre Pflege und Zucht. Wochenschr. Aquar.-Terrar. Kunde, 1906, 3. Jahrg., 527-528; 579-580; 607-609. 4 figs. Add. 1906.1

Badis badis (Ham. & Buch.) *Barbus phutunio* (Ham. & Buch.) und *Cyprinodon dispar* Rüpp.

Stansch, K., Henkel, Fr., & Baum, H. See **Henkel, Baum, & Stansch.**

Stazzi, Pietro. La malattia de' barbi. Psorospermiosi o myxoboliasi tuberosa de' barbi. Clin. Vet., Milano, 1906, 29, 56-60. 3 figs. Add. 1906.1
See also Stazzi, P., 1906.1.

Stead, David G. *Amia roseigaster* [cheilodipterid] an oral incubator. Proc. Linn. Soc. New South Wales, 1905 (1906), 30, 486. Add. 1906.1

— [Exhibition of and remarks on some Australian syngnathids] Proc. Linn. Soc. New South Wales, 1906 (1907), 31, 428. Add. 1907.1

— [Exhibition of and remarks on two species of mullets] Proc. Linn. Soc. New South Wales, 1906 (1907), 31, 60. Add. 1907.2

— [Exhibition of specimens of fishes new to the waters of New South Wales with remarks on the same] Proc. Linn. Soc. New South Wales, 1906 (1907), 31, 174, 496, 556. Add. 1907.3

— [Notes on some rare south Australian fishes] Proc. Linn. Soc. New South Wales, 1906 (1907), 31, 673. Add. 1907.4

— Notes on the eggs and breeding habits of fishes, with special reference to Australian species. Sydney, 1907. 61 p. 16 figs. Add. 1907.5

Oral gestation in *Galeichthys thalassinus* on p. 47-50; and in *Amia roseigaster*, a cheilodipterid.

— [On some young *Galaxias* found aestivating in and dug out of damp soil in Tasmania] *Proc. Linn. Soc. New South Wales*, 1906, (1907), **31**, 430–431. Add. 1907.6

— [On the aestivating *Galaxias* of Tasmania] *Proc. Linn. Soc. New South Wales*, 1906, (1907), **31**, 566–567. Add. 1907.7

— [Faunal records for *Gonorhynchus gonorhynchus* in New South Wales] *Proc. Linn. Soc. New South Wales*, 1907 (1908), **32**, 744. Add. 1908.1

— [On the tunny, *Germo maccoyi*, new to the fauna of New South Wales] *Proc. Linn. Soc. New South Wales*, 1907 (1908), **32**, 392–393. Add. 1908.2

— On the need for more uniformity in the vernacular names of Australian edible fishes. *The Australian Naturalist. Journ. Mag. Australian Naturalist Club*, 1911, **2**, 103–104. Add. 1911.1

Stearns, Robert E. C. Fish parasites in *Meleagrinae*. *Science*, 1887, **9**, 135–136. Add. 1887.1

Fierasfer and *Oligocottus* imbedded in the nacreous substance.

Steenstrup, J. J. S. Développement du *Blennius viviparus*. *Arch. Sci. Biol. Univers.*, 1865, **24**, 160. Add. 1865.1

Steier, August. Der Tierbestand in der Naturgeschichte des Plinius. Würzburg, 1913. Add. 1913.1

Steilen, D. Vom Fischfang und der Unterweser. *Fischerbote*, 1912, **4**, 247–250. Add. 1912.1

Stein, Sophus August Wilhelm, [1797–1868] . . . de thalamo et origine nervi optici in homine et animalibus vertebratis dissertatio anatomica. Hauniæ, 1834. 66 p. 12 pls. 4°. Add. 1834.1

Steinach, Eugen. Ueber Farbenwechsel bei niederen Wirbeltieren bedingt durch direkte Wirkung des Lichtes auf die Pigmentzellen. *Centralb. Physiol.*, 1891, **5**, 326–330. Add. 1891.1

Flounder and eel used.

Steinbach, — (Dr.) Bericht über die Gesundheitsverhältnisse der Eingeborenen der Marshall-Inseln im Jahre 1893–94 und Bemerkung über Fischgift. *Mittheil. Forschungsreis. Gelehrt. Deutsch. Schutzgeb.*, 1895, **8**, 157–171. Add. 1895.1

Poisoning from eating fishes, 163–170; from spines of fishes, 170–171.

Steinberg, F. A. von. Gründliche Nachricht von dem in Inner-Crain liegenden Czirknizer-See worinnen alle Seltenheiten desselben beschrieben, wie nemlich jährlich in solchen gefischt, gejaget, gesäet, und eingeärdnet, Heu und Streu eingebracht und die Oeconomie besorget werde. Grätz, 1761. 34 pls. 4°. Add. 1761.1

Much about fishing, with 6 plates of fishing scenes.

Steindachner, F. [1834–1919] Bericht über eine Sammlung von Fischen aus Japan bei Nagasaki. *Annal. K. K. Naturhist. Hofmuseums Wien*, 1892, **7**, pt. 4, 153–155. Add. 1892.1

— Beiträge zur Kenntniss der Flussfische Südamerikas. *Denkschr. K. Akad. Wiss. Wien*, 1915, **5**. Add. 1915.1

— Beiträge zur Kenntnis der Flussfische Südamerikas, V. *Anz. Akad. Wiss. Wien*, 1915, **52**, 217–219. Add. 1915.2

— Ichthyologische Beiträge. XVIII. Sitzber. *Acad. Wiss. Wien*, 1915, **124**, 567–591. 5 pls. Add. 1915.3

— Vorläufiger Bericht über einige neue Süßwasserfische aus Südamerika. *Anz. Akad. Wiss. Wien*, 1915, **52**, 199–202. Add. 1915.4

— Bericht über die ichthyologischen Aufsammlungen der Brüder Adolf und Albin Horn während einer im Sommer 1913 ausgeführten Reise nach Deutsch-Ostafrika. *Denkschr. Akad. Wiss. Wien*, 1916, **92**, 59–86. 5 pls. Add. 1916.1

Steiner, J. Ueber die Wirkung des amerikanischen Pfeilgiftes. *Arch. Anat. Physiol.*, 1875, 145–176. Add. 1875.1

Experiments on various elasmobranchs and teleosts.

Steinmann, G. Rückblick auf den Entwicklungsgang der Pflanzen- und Tierwelt. (In Steinmann, G., Einführung in die Paläontologie, 2. Auflage. Leipzig, 1907, 10–16.) Add. 1907.1

Brief reference to fishes on p. 13.

Steinmann, Paul. Ueber die Bedeutung des Labyrinthes und der Seiten-organe für die Rheotaxis und der Bewegungsrichtung bei Fischen und Amphibien. Verh. Naturf. Gesell. Basel, 1914, **25**, 212-243. 7 figs.

Add. 1914.1

Stejneger, Leonard. The origin of the so-called Atlantic animals and plants of western Norway. Smithson. Misc. Coll., 1907, **48**, 458-513.

Add. 1907.1

Blennius pholis, or shanny, p. 492.

Stendell, W. Zur vergleichenden Anatomie und Histologie der Hypophysis cerebri. Arch. Mikr. Anat., 1913, **82** (Abth. 1), 289-332.

Add. 1913.1

Step, Edward. Messmates; a book of strange companionships in nature. New York, 1914. 220 p. 55 pls.

Add. 1914.1

Fishes as commensals and mutualists.

Stéphan, Pierre. Existe-t-il des lésions constantes chez les poissons pêchés à la dynamite? C. R. Mém. Soc. Biol. Paris, 1904, **56**, 128.

Add. 1904.1

Stéphan, P., Cotte, J., Gaver, F. van, & Darboux, G. See **Darboux, Stéphan, etc.**

Stephanssyn, Olaf. Um siáfar-abla og fleiri vatna veidar á Islandi. Rit Pesz Islenzka Laerdoms-Lista Felags, 1787, **7**, 1-64.

Add. 1787.1

Concerning fresh-water fishing in Iceland.

Stephens, J. W. W., & Boyce, Robert. A parasitic disease in the haddock (*Gadus aeglefinus*). Centralb. Bakteriolog., Jena, 1905, **36**, (Abth. 1), Ref. 149. — Hyg. Rundschau, Berlin, 1906, **16**, 76.

Add. 1906.1

Abstracts of Stephens, & Boyce, 1904.1.

Sterne, Carus. Die Brutpflege der Fische. Prometheus, 1901, **13**, no. 632.

Add. 1901.1

Viviparity especially.

Sternfeld, B. Ueber die Structur des Hechtzahnes, insbesondere die des Vasodentins. Arch. Mikr. Anat., 1882, **20**, 382-412. 2 pls.

Add. 1882.1

Steuart, James. Notes on Ceylon . . . to which are appended some observations . . . on the pearl fisheries. London, 1862.

Add. 1862.1

Reference to *Rhineodon typus*, p. 156.

Steuer, A. Planktonkunde. Mitth. Deutsch. Seefischerei Ver., 1911, **27**, 264-268.

Add. 1911.1

Eggs of *Scomberesox*, *Lophius piscatorius* and *Bathylchnus cyaneus*, figured and described.

Stevenson, Charles H. A review of the foreign fishery trade of the United States. Rept. U. S. Fish Comm., 1894 (1896), **20**, 431-571.

Add. 1896.1

— The restricted inland range of shad due to artificial obstructions and its effect on natural reproduction. Bull. U. S. Fish Comm., 1897 (1898), 265-271.

Add. 1898.1

— The preservation of fishery products for food. Bull. U. S. Fish Comm., 1898 (1899), **18**, 335-563. 43 pls.

Add. 1899.1

— The shad fisheries of the Atlantic coast of the United States. Rept. U. S. Fish Comm., 1898 (1899), 101-269.

Add. 1899.2

— Aquatic products in arts and industries. Fish oils, fats, and waxes. Fertilizers from aquatic products. Rept. U. S. Fish Comm., 1902 (1904), **28**, 177-279. 16 pls.

Add. 1904.1

— Utilization of the skins of aquatic animals. Rept. U. S. Fish Comm., 1902 (1904), **28**, 281-352. 13 pls.

Add. 1904.2

Stevenson, T. Poisoning by sardines; a toxic ptomaine. Brit. Med. Journ., London, 1892, **2**, 1326.

Add. 1892.1

Stewart, C. (editor). Descriptive and illustrated catalogue of the physiological series of comparative anatomy in the museum of the Royal College of Surgeons of England. 3 vols. London, 1900-07. ills. 8°.

Add. 1900.1

The 2nd ed., with the assistance of R. H. Burne in vols. 2 & 3.

Stewart, W. C. The practical angler; or the art of trout-fishing, more particularly applied to clear water. Seventh edition. Edinburgh, 1877. xvi, 228 p. 8°.

Add. 1877.1

Other editions are: (1st, 2nd, & 3rd) Edinburgh, 1857; 1861, 1867, 1874.

Stiasny, G. Beobachtungen über die marine Fauna des Triester Golfes während des Jahres 1910. Zool. Anz., 1911, **37**, 517-522.

Add. 1911.1

Sticker, Anton. Ueber Infektionskrankheit bei Fischen. Arch. Animal.

Nahrungsmittelk., Cöln, 1893, 8, 121-124. — Zeitschr. Fischerei, Leipzig, 2, 85-90. Add. 1893.1

Stiles, Charles Wardell [1867-] Notes sur les parasites — 24: Note préliminaire sur un espèce d'infusoires (*Ichthyophthirius*) parasites chez des poissons d'eau douce à l'Exposition Internationale de Chicago. C. R. Mém. Soc. Biol. Paris, 1894, 6. ser. 1, 434-436. Add. 1894.1

— Note sur un protozoaire (*Ichthyophthirius multifiliis*) parasite des poissons conservés dans les aquariums de l'exposition universelle de Chicago. Bull. Soc. Centr. Aquic. France, Paris, 1894, 2. ser. 6, 165-167. Abstract in Journ. Roy. Micr. Soc., London, 1895, 2. ser. 15, 327. Add. 1894.2

— Frogs, toads, and carp (*Cyprinus carpio*) as eradicators of fluke disease. Vet. Journ. London, 1903, 57 (n. s. 45), 149-150. — Arch. Naturg., Berlin, 1905, 64. Jahrg. (vol. 2), 50. Add. 1903.1

See also Stiles, C. W., 1902.1.

Stirling, W. On the ferments or enzymes of the digestive tract in fishes. Journ. Anat. Physiol. London, 1884, 18, 426-435. Add. 1884.1

Stoddart, Thomas Tod. The art of angling as practised in Scotland. 2nd ed. Edinburgh, 1836. iv, 164 p. 16°. Add. 1836.1

First edition, Edinburgh, 1835.

— The angler's companion to the rivers and lochs of Scotland. 3rd ed. Edinburgh & London, 1864. 8°. Add. 1864.1

Other editions are: Edinburgh & London, 1847. xiii, 431 p. 8°; and 1853.

Stölzle, A. Das Tegernseer Angel- und Fischbüchlein. Oesterr. Fischerei Zeitg., 1912, 9, 12-13. Add. 1912.1

Stone, Livingstone. Transportation of fish. Trans. Amer. Fish-cult. Assoc., 1880, 20-30. Add. 1880.1

— Does the panther (*Felis concolor*) go into the water to kill fish? Proc. U. S. Nat. Mus., 1883, 5, 570. Add. 1883.1

— Domesticated trout. How to breed and grow them. (n. p.), 1896. 482 p. illust. 8°. Add. 1896.1

Other editions are: Boston, 1872, and 1873; Charleston, N. H., 1877, (3rd ed., revised and enlarged).

— Some brief reminiscences of the early days of fish-culture in the United States. Bull. U. S. Fish Comm. 1897 (1898), 337-343. Add. 1898.1

Stow, George W. The native races of South Africa. London, 1905. 618 p. illust. Add. 1905.1

Bushmen fishing, p. 72; 92-94.

Stranahan, J. J. Black bass culture in Ohio. Forest & Stream, 1882, 19, 112. Add. 1882.1

— Rearing black bass. Forest & Stream, 1893, 40, 277. Add. 1893.1

— The methods, limitations, and results of white-fish culture in lake Erie. Bull. U. S. Fish Comm. 1897 (1898), 315-319. Add. 1898.1

Strandberg, Olof. Anmärkningar vid fisket i Hjelmaren. K. Svensk. Vetensk. Acad. Handl., 1772, 33, 79-84. Add. 1772.1

— Ueber die Fischerey in Hielmar. König. Schwed. Akad. Abhandl., 1772, 34, 74. Abstract in Comment. Lipsiens., 21, 630. Add. 1772.2

See note under Küstner, A. G. in Pre-Linn. section.

Stratton, Henry. Facts in the habits of the goldfish (*Cyprinus auratus* L.) and silver fish (*C. auratus* var.) Mag. Nat. Hist., 1833, 6, 527-28. Add. 1833.1

Stricker, M. *Metynnis unimaculatus*. Wochenschr. Aquar.-Terrar. Kunde, 1908, 5. Jahrg., 411. Add. 1908.1

— *Pyrrhulina filamentosa*. Wochenschr. Aquar.-Terrar. Kunde, 1908, 5. Jahrg., 400. Add. 1908.2

Strickland, Hugh Edwin. Fossil fish (*Pholidophorus*) Ann. Mag. Nat. Hist., 1840, 6, 237. Add. 1840.1

Strigel, Anton. Die Fischereipolitik der Bodenseeorte in älterer Zeit, mit besonderer Rücksicht auf Ueberlingen. Inaug. Dissert. Freiburg, 1910. 62 p. — Schrift. Ver. Gesch. Bodensees, 39, 94-156, —. Abstract by J. Schultze in Arch. Fischereigesch., 1913 Heft 1, 209-210. Add. 1910.1

Strøm, Hans. Beskrivelse over en Norsk saltvands-fisk, kaldet byrkelauge. (*Gadus dipterygius*) Norske Vidensk. Selsk. Skrift., 1767, 3, 446-452. Add. 1767.1

See Strøm, H., 1767.1.

Strøm, H.

— Sammenligning imellem de Norske og Svenske fiskerier. Dansk Museum, Kjøbenhavn, 1782, 1, 1-21. 8°. Add. 1782.1

— Om torske-fiskerie [Gadus] med garn. Nye Saml. Norske Vid. Selsk. Skrift., 1788, 2, 401. Add. 1788.1

Stromer von Riechenbach (*Baron*) *Ernst*, [1871-] Ueber die Bedeutung der fossilen Wirbeltiere Afrikas für die Tiergeographie. Verh. Deutsch. Zool. Ges., Leipzig, 1906, 16, 204-218. Add. 1906.1

— Ueber Altertiär in Westafrika und die Südatlantis. Jahrb. K. Preuss. Geol. Landesanstalt Bergakad., 1909, 30, 512-513. Add. 1909.1

Stromeyer, H. Zur Geschichte der badischen Fischerzünfte. Karlsruhe, 1910. Add. 1910.1

Strong, A. B. The illustrated natural history, containing scientific and popular descriptions of . . . fishes . . . etc. 3 vols. New York, 1851. 144 pls. 8°. Add. 1851.1

Studnička, František Karel. Ueber das Vorkommen von Kanälchen und Alveolen im Körper der Ganglienzellen und in dem Axencylinder einiger Nervenfasern der Wirbeltiere. Anat. Anz., 1899, 16, 396-401. Add. 1899.1

In Petromyzon, Myxine und Lophius.

— Ueber einige Modificationen des Epithelgewebes (Schmelzpulpa der Wirbel-Zahnanlage, die Hornzähne der Cyclostomen, die Epidermis von *Ophidium barbatum*, &c.) Sitzb. K.-Boehm. Ges. Wissen. Prague, 1900, no. 14. 22 p. illust. 8°. Add. 1900.1

— Die primäre Augenblase und der Augenbecher bei der Entwicklung des Seitenauges der Wirbeltiere. Anat. Anzeig., 1913, Bd. 44, 273-301, 16 pls. Add. 1913.1

Proammocoetes, Petromyzon, Acipenser, Lophius, and Pristiurus studied.

Sturtevant, E. L. Rapid growth of the pickerel (*Esox reticulatus*) Amer. Naturalist, 1871, 5, 313-314. — 5. Rept. Comm. Inland Fisheries Massachusetts, 1871. Add. 1871.1

Sullivan, James. The history of the district of Maine. Boston, 1795. map. Add. 1795.1

Notes on the salmon, sturgeon and alewife fisheries.

Sumner, Francis B. Observations on the germ layers of teleost fishes. Science, 1899, n. s. 9, 718. Add. 1899.1

Sund, Oscar. Oversigt over Norsk fiskeri-og havforskning, 1900-1908 [Review of Norwegian fishery and marine investigations [of the "Michael Sars" expedition], 1900-1908] Rept. Norwegian Fishery Marine Invest., 1909, 2, no. 1. 204 p. 21 pls. 8°. Add. 1909.1

Supino, Felice. Le cure parentali nei pesci. Boll. Soc. Lombardo Pesca Acquicult., 1910, 2. ann., no. 9. Add. 1910.1

Breeding habits of *Chromis multicolor*.

— Sopra la alimentazione e la struttura dello stomaco nei pesci. Rendic. Instit. Lomb., Milano, 1914, 47, 319-330. Add. 1914.1

Surbeck, G. L. Eine neue Krankheit beim Bachsaibling. Deutsch. Fischerei Zeitg., 1900, 25, 367-368. Add. 1900.1

Surber, Thaddeus. Notes on the natural hosts of freshwater mussels. Bull. U. S. Fish Comm. 1912 (1914), 32, 101-116. Add. 1914.1

Susta, Josef. Fünf Jahrhunderte der Teichwirtschaft zu Wittingau. Stettin, 1898. pls. map. Add. 1898.1

Sutton, (Sir) John Bland. On an exostosis from a fish. Trans. Path. Soc. London, 1888, 39, 472-476. Add. 1888.1

Suvorov, E. K. L'anchois de la Caspienne (*Harengula delicatula* Nordm.) et son importance industrielle [Text in Russian] Mater. Pozn. Russk. Rybolov., Petrograd, 1913, 3, no. 3, 1-55. Add. 1913.1

Résumé in French.

Swain, Joseph. A description of a new species of Hadropterus (*Hadropterus scierus*) from southern Indiana. Proc. U. S. Nat. Mus., 1883 (1884), 6, 252. Add. 1884.1

Swainson, William. A treatise on taxidermy: with the bibliography of zoologists. (In vol. 126 of Lardner's Cabinet Cyclopædia) London, 1840. 8°. Add. 1840.1

— Taxidermy made easy; being plain and practical directions for pre-

serving, setting up and embellishing all kinds of quadrupeds, birds, fishes, reptiles, insects, etc. 4th ed. London, 1870. pl. 12°. Add. 1870.1

Swan, Allan P. The fungus of salmon disease: its life and function. Rept. Proc. Belfast Nat. Hist. Soc. 1888-89, 54-85. pl. Add. 1889.1

Sweeney, Z. T. Data on fishes of Indiana. Bienn. Rept. Comm. Fisheries & Game Indiana 1903-04 (1905), 33-112. pls. & figs. Add. 1905.1

— Data on fishes. Bienn. Rept., Comm. Fisheries & Game, Indiana 1905-06 (1906), 29-231. Add. 1906.1

Swinburne, Henry. Travels in the two Sicilies in the years 1777-1780. Dublin, 1783. Add. 1783.1

Native names of fishes of Taranto, p. 251-252.

Swithinbank, Harold, & Bullen, G. E. The scientific and economic aspects of the Cornish pilchard fishery. I, The food and feeding habits of the pilchard in coastal waters. Mera Public., no. 1. St. Albans, 1913. 27 p. Add. 1913.1

— The scientific and economic aspects of the Cornish pilchard fishery. II, The plankton of the inshore waters in 1913 considered in relation to the fishery. Mera Public., no. 2. St. Albans, 1914. 32 p. Add. 1914.1

Symson, Andrew. Large description of Galloway, 1684. Edinburgh, 1823. Add. 1823.1

Quoted by R. Jameson in Edinburgh New Phil. Journ., 1826, 1, 187, as to shower of fishes.

Szirmay, András Ignác. Dissertatio inaug. medico-zoologica sistens: pisces aquarum Hungariæ. Vindobonæ (Vienna), 1840. 24 p. 4°. Add. 1840.1

Sztripszky, Hiador. Daten zur Geschichte der ungarischen Fischerei. Anz. Ethnog. Abth. Ungar. Nat. Mus., Ergänzungsheft, Beibl. 1, 1902, 89. Add. 1902.1

— Ueber die Fischerei in dem Szabolcser Morotva. Anz. Ethnog. Abth. Ungar. Nat. Mus., Ergänzungsheft, Beibl. 1, 1902, 167-169. Add. 1902.2

Fishing methods with 4 figures of implements.

T

Tahara, Y. Ueber die giftigen Bestandteile des Tetrodon. Zeitschr. Med. Ges. Tokio, 1894, 8. — C. R. Cong. Internat. Hyg. Démog. 1894, Budapest, 1896, 8, pt. 4, 198-207. Add. 1896.1

— Le poison du tetrodon. La Nature, 1912, 40, pt. 2, 238.

Add. 1912.1

French translation of Tahara, Y., 1910.1.

Takahashi, N., & Ishikawa, C. See **Ishikawa & Takahashi.**

Takei, S. Edible and poisonous fish [Text in Japanese] 2 vols. Yedo, 1831. 8°. Add. 1831.1

Tanaka, Shigeho. Figures and descriptions of the fishes of Japan. Tokyo, 1912-1914, nos. 5-15, p. 71-262. 53 pls. Add. 1912.1

For preceding numbers see Tanaka, S., 1911.2.

— Note on a Monopterus from Nijo, Kyoto [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 1, 17-18. Add. 1914.1

— Note on an Acipenser from Hakodate [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 3, 13. Add. 1914.2

— On the methods of collection of fishes [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 1, 2-5. Add. 1914.3

— Sexual differences of *Hali-choeres pæcilipterus* [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 1, 1-2. pl. Add. 1914.4

— Synopsis of Japanese fishes [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 1, 8-11. Add. 1914.5

Tanaka, Shigeho, & Miyamoto, Kunimoto. On the fishes of the bay of Ise [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 2, 12-14. Add. 1914.1

Tanaka, Shigeho, & Yoshinaga, Torama. Artificial propagation of *Ma-*

cropodus opercularis [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 1, 18-19. Add. 1914.1

Tanner, Z. L. The use of the electric light in fishing. Bull. U. S. Fish Comm. 1885, 5, 464. Add. 1885.1

— On the appliances for collecting pelagic organisms, with special reference to those employed by the United States Fish Commission. Bull. U. S. Fish Comm., 1894, 14, 143-151. 3 pls. Add. 1894.1

— Deep-sea explorations; a general description of the steamer "Albatross," her appliances and methods. Bull. U. S. Fish Comm., 1896 (1897), 16, 257-428. 40 pls. & 76 figs. Add. 1897.1

Taurke, F. Die Fischzucht und Fischhaltung in Gewässern aller Art und Grösse, besonders in Teichen. Bautzen, 1908. 271 p. 8°. Add. 1908.1

Tawara, R. Report on the poisonous substance in Tetrodon [Text in Japanese] Chiugai Iji Shinpo, Tokio, 1894, no. 344, 4-9. Add. 1894.1

Taylor, J. E. The aquarium, its inhabitants, structure and management. Edinburgh, 1901. 316 p. illust. Add. 1901.1

Fishes, p. 175-227.

Taylor, Richard. Te Ika A Maui, or New Zealand and its inhabitants. 2. ed. revised and enlarged, London, 1870. Add. 1870.1

Fishes (with native names), p. 410-414, p. 623-628; fishing methods, p. 499.

Taylor, R. E. Flying-fish. Nature. 1880-81 (1881), 23, 388. Add. 1881.1

Taylor, W. Edgar. Establishment of a biological station on the Gulf coast. Bull. U. S. Fish Comm. 1897 (1898), 17, 185-188. Add. 1898.1

Tchistovich, Th. See Čistovič, F. J.

Tello, Francisco. Las neurofibrillas en los vertebrados inferiores. Traba-

jos Laboratorio Biologicas Universidad Madrid, 1904, 3, 147-150.

Add. 1904.1

Temminck., C. J., & Schlegel, H. Pisces (In Siebold, Ph. Fr. von, Fauna Japonica, sive descriptio animalium quæ in itinere per Japoniam suscepto annis 1823-30 collegit, etc.) 2 vols. Lugduni Batavorum, 1842-50, 323 p. 160 pls. fol.

Add. 1842.1

Text and plates in separate volumes.

Originally issued in parts, 1842-50. For dates of issue of these parts, see note by Sherborn & Jentink in Proc. Zool. Soc. London, 1895, p. 149. See also in Vol. II, Siebold, P. F. von, 1842.1.

Terra, Paul de. Vergleichende Anatomie des menschlichen Gebisses und die Zähne der Vertebraten. Jena, 1911. 451 p. 200 figs. 8°.

Add. 1911.1

Teeth of fishes, p. 197-221. 22 figs.

An authoritative work with an extensive bibliography.

Tesson, A. de. Phénomènes maritimes (*suite*). — Les poissons-calfats de Guaymas ou le chant des poissons . . . les bancs de poissons, etc. Rev. Trimest. Soc. Archéol. Avranches & Mortain, 1884, 2, 144.

Add. 1884.1

Teutleben, Ernst von. Ueber Kaumuskeln und Kaumechanismus bei den Wirbelthieren. Arch. Naturg., 1874, Bd. 40, 1. Th., 78-110. 7 pls.

Add. 1874.1

Fische, p. 106-110.

Thallwitz, J., Schiller, K., & Schorler, B. See **Schorler, Thallwitz & Schiller.**

Thélohan, Prosper. Sur deux coccidies nouvelles parasites de l'épinoche et de la sardine. Ann. Microg., Paris, 1890, 2, 475-484. Abstract in Jahresb. Fortschr. Lehre Path. Mikroorganism., Braunschweig, 1894, 8, 449-450.

Add. 1890.1

See also Thélohan, P., 1890.1.

— Sur deux sporozoaires nouveaux parasites des muscles des poissons. C. R. Acad. Sci. Paris, 1891, 112 (pt. 3), 168-171.

Add. 1891.1

— Sur des sporozoaires indéterminés parasites des poissons. Journ. Anat. Physiol. Paris, 1892, 28, 163-171. 7 figs.

Add. 1892.1

— Sur quelques nouvelles coccidies parasites des poissons. C. R. Acad. Sci. Paris, 1892, 114 (pt. 3), 136-138. — Journ. Anat. Physiol., Paris, 1892, 28, 151-152. — Jahresb. Fortschr.

Lehre. Path. Mikroorg., Braunschweig, 1894, 8, 448-449.

Add. 1892.2

See also Thélohan, P., 1892.2.

— Altérations du tissu musculaire dues à la présence de myxosporidies et de microbes chez le barbeau. C. R. Soc. Biol., Paris, 1893, 9. ser. 5, 267-270. Abstracts in Centralb. Bakteriologie, Jena, 1893, 14, 532. — Zeitschr. Fleisch. Milchhyg., Berlin, 1893, 4.

Add. 1893.1

— Note sur une tumeur observée chez l'épinoche. C. R. Soc. Biol., Paris, 1893, 9. ser. 5, 591-592.

Add. 1893.2

Theobald, F. V. Thrasher or fox shark [*Alopias vulpes*] at Rye. Zoologist, 1885, 3. ser. 9, 352.

Add. 1885.1

Thilo, Otto. Die Körperformen der Fische und Seesäugethiere. Samml. Gemeinstand. Wiss. Vorträge, 1898, n. s. 13, 451.

Add. 1898.1

See also Thilo, O., 1898.2

— Sperrvorrichtungen im Tierreiche. Biol. Centralb., 1899, 19, 504-517. 13 figs.

Add. 1899.1

— Ergänzungen zu meiner Abhandlung "Sperrvorrichtungen im Tierreiche." Biol. Centralb., 1900, 20, 451-460. 7 figs.

Add. 1900.1

Stop mechanisms in fishes.

— Stop or click mechanisms in the animal kingdom. Journ. Anat. Physiol., London, 1901, 15, 205-213. 2 pls.

Add. 1901.1

Catch mechanisms in fishes, i.e. catfish spines.

— Naturforschung und Technik [Kinematik im Tierreich]. Vortrag gehalten im Deutschen Museum am 29. Oktober 1910. Vorträge und Berichte Deutsches Museum, München, [1910], Heft II. 24 p. 25 figs.

Add. 1910.1

Thomas, Eugène Armand. De l'huile de foie de morue. Paris, 1854. 42 p. 4°.

Add. 1854.1

Thomas, N. W. Natives of Australia (In his Native races of the British Empire) London, 1906. 256 p. illust.

Add. 1906.1

Fishing, p. 89-96; with the remora, p. 90; by poisoning the water with Duboisia, p. 89.

Thomassy, Marie Joseph Raymond. Histoire de la pêche dans les deux mondes. Revue Contemporaine, 1852. 40 p.

Add. 1852.1

Correct title for Thomassy, M. J. R., 1852.1.

Thompson, Allen. On the development of the vascular system in the foetus of vertebrated animals. Part II. Edinburgh New Phil. Journ., 1831, n. s. 10, 88-111. 2 pls. & 43 figs. — Froriep's Notizen, 1833, 35, pt. 2, 135. Add. 1831.1

Deals with sharks and rays.

Thompson, David Purdie. Introduction to meteorology. Edinburgh & London, 1849. Add. 1849.1

Rains of fishes, 162-164.

Thompson, Edward. Edible qualities of carp. Bull. U. S. Fish Comm., 1884, 4, 176. Add. 1884.1

Thompson, John. Voice of fishes. Mag. Nat. Hist., 1830, 3, 147. Add. 1830.1

Thompson, W. Wardlaw, & Gilchrist, J. D. F. See **Gilchrist & Thompson.**

Thomson, Basil. The Fijians. A study of the decay of custom. London, 1908. 396 p. Add. 1908.1

Fishing with spears, bows and arrows, fences, etc., pp. 320-327.

Thomson, J. Arthur [1861-] The biology of the seasons. London, 1911. 384 p. 11 pls. Add. 1911.1

The eel-fare p. 41-50; story of the salmon, p. 299-303.

— Cyclostomata or marsipobranchs. (In Cunningham, J. T. (editor) Reptiles, amphibia, fishes and lower chordata. London, 1912, p. 441-455) Add. 1912.1

— The lancelets. Cephalochorda. (In Cunningham, J. T. (editor) Reptiles, amphibia, fishes and lower chordata. London, 1912, p. 457-473). Add. 1912.2

Thoreau, H. D. Esox from Concord. Proc. Bost. Soc. Nat. Hist. 1856-59 (1859), 6, 430. Add. 1859.1

Thorndike, Edward L. A note on the psychology of fishes. (In his Animal intelligence: experimental studies. New York, 1911, p. 169-171. 2 figs.) Add. 1911.1

Reprint of Thorndike, E. L., 1899.1.

Thoulet, J. L'enseignement pratique de l'océanographie dans les écoles d'hydrographie et les écoles de pêche. Bull. Trim. Enseign. Pêches Marit., Paris, 1911, 16, 438-454. Add. 1911.1

Thumm, Johannes. Ueber die Zucht von Aquarienfischen. Wochenschr. Aquar.-Terrar. Kunde, 1907, 4. Jahrg., 53-54. Add. 1907.1

Oral gestation in *Tilapia macrocephala* from Bight of Benin.

Thurston, Edgar [1855-] Inspection of Ceylon pearl banks (In his Pearl and chank fisheries of the gulf of Manaar, p. 36-38. Bull. Madras Govt. Mus., 1894, no. 1.) Add. 1894.1

Figure and note on *Rhinodon typicus*.

— Rámésvaram island and the fauna of the gulf of Manaar. Bull. Madras Govt. Mus. 1895, no. 3, 79-138. Add. 1895.1

Lists of fishes.

Tiburtius, Tiburtz. Mittel, die Fische bey grosser Kälte in den Teichen zu erhalten. Neue Gesellsch. Erzähl., 1758, 1, 174. Add. 1758.1

— Vortheile bey den Fischwinterungen und Aufeisen der Weyher. Fränkische Samml., 1760, 5, 248. Add. 1760.1

— Försök giorde vid fiske-plantering i små skogs-sjöar. K. Svensk. Wet. Acad. Handl., 1768, 30-39. Add. 1768.1

— Versuche, Fische in kleine Waldseen zu pflanzen. König. Schwed. Akad. Abhandl., 1768 (1771), 30, 32. Abstract in Comment Lips., 17, 59. Add. 1771.1

See note under Kästner, A. G., in Pre-Linn. section.

— 'Teiche müssen im Winter nicht aufgehauen werden. Berlin Samml., 1772, 4, 261. Add. 1772.1

— Mittel, die Fische in Teichen den Winter über vor dem Sterben zu bewahren. Zinkii Leipz. Samml., [1774] 2, 379. Add. 1774.1

— Untersuchung wie die Fische des Winters unter dem Eise zu erhalten. Dresd. Gel. Anz., 1759, 5. St. — Neu Hamb. Magaz., 1775, 94. St., 372. Add. 1775.1

Tiele, Pieter Anton. Mémoire bibliographique sur les journaux des navigateurs néerlandais réimprimés dans les collections de De Bry et de Hulsius . . . la plupart en la possession de F. Muller. Amsterdam, 1867. xii, 372 p. pl. 8°. Add. 1867.1

— *Nederlandsche bibliographie van land en volkenkunde.* Amsterdam, 1884. 288 p. Add. 1884.1

Tigerstedt, Robert. Die Produktion von Wärme und Wärmehaushalt (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. III, Hälfte 2, p. 1-104. 13 figs. Jena, 1910). Add. 1910.1

Fische, p. 47-48.

Tikhenko, S. Sur l'origine du mésenchyme chez le sterlet (*Acipenser ruthenus*) Zool. Anz. 1906, 30, 728-730. 2 figs. Add. 1906.1

Tilney, Frederick. Contribution to the study of the hypophysis cerebri with especial reference to its comparative histology. Mem. Wistar Inst. Anat. Biol., 1911, no. 2. 78 p. 2 figs. 12 pls. Add. 1911.1

Comparative histology of the pituitary gland and a report of six hypophysectomies on *Petromyzon*, *Squalus*, *Anguilla*, *Lepidosteus*. p. 28-35.

Tirant, Gilbert. Mémoire sur les poissons de la rivière de Hué. Saïgon, 1883. 24 p. 8°. Add. 1883.1

Titcomb, John W. Progress and experiments in fish culture during the past year in the Bureau of Fisheries. Trans. Amer. Fisheries Soc., 1905, 57-74. Add. 1905.1

— Report on the propagation and distribution of food fishes. Rept. U. S. Fish Comm. 1903 (1905), 29-74. Add. 1905.2

— Aquatic plants in pond culture. 1909. 31 p. pl. & 32 text-figs. Add. 1909.1

— The use of copper sulphate for the destruction of obnoxious fishes in ponds and lakes. Trans. Amer. Fisheries Soc., 1914, 20-26. Add. 1914.1

Tjeenk Willink, H. D. De "Songkeat" een Vischparasiet. Natuurk. Tijdschr. Nederl. Indië, Weltevreden, 1905, 64 (10. ser. 8), 156-161. Add. 1905.1

Todaro, Francesco. Gli organi del gusto e la mucosa bocca-branchiale dei Selaci. (In Ricerche fatte nel laboratorio di anatomia normale della R. Università di Roma nell'anno 1872, publicate del Dr. F. Todaro, Roma, 1873. 3 pls.) Add. 1873.1

For French translation see Todaro, F., 1873.1.

Tolke, C. The pollution of public waters by refuse from factories. Rept. U. S. Fish Comm. 1879 (1882), 7, 619-624. Add. 1882.1

Tomes, Charles Sissmore. A manual of dental anatomy, human and comparative. 7. edition, reviewed and extended by H. W. Marett Tims & A. Hopewell Smith. London, 1914. 616 p. illust. Add. 1914.1

Teeth of fishes, chap. x, pp. 276-304, and elsewhere.

Tomuolo, Aristide. I fregoriferi come mezzo impulsivo alla industria della pesca e alla igienica conservazione dei pesci. Neptunia, Venezia, 1904, 19, 164-173. Add. 1904.1

Tomlinson, Charles. The rain-cloud and the snowstorm. London, 1865. Add. 1865.1

Rain of fishes, p. 193-194.

Toppelius, O. A. Disquisitio anatomica, nervum trigeminum partemque cephalicam nervi sympathici *Gadi lotæ*, Linn., cum nervis iisdem apud hominem et mammalia comparans, quam . . . p. p. E. J. Bonsdorff . . . respondente O. A. Toppelius, &c. Inaug. Dissert. Helsingforsiae, 1846. 52 p. pl. 4°. Add. 1846.1

Tower, Ralph Winfred. Improvements in preparing fish for shipment. Bull. U. S. Fish Comm. 1899 (1901), 231-235. Add. 1901.1

Townsend, Charles Haskins [1859-] Notes on the natural history and ethnology of northern Alaska (In Healy, M. A. Report of the cruise of the revenue steamer "Corwin" in the Arctic ocean, in the year 1885, Capt. M. A. Healy, commander. Ex. Doc. no. 153, House Representatives, 49. Cong., 3rd sess., Washington, 1887) Add. 1887.1

Fishes, p. 95-96; 101-102.

— Description of a closing tow-net for submarine use at all depths. Rept. U. S. Fish Comm. 1894 (1896), 20, 279-282. Add. 1896.1

— Pollution of streams — an appeal to anglers. Bienn. Rept. Comm. Fisheries & Game Indiana 1907-08 (1908), 426-432. Add. 1908.1

See also Townsend, C. H., 1907.1.

— Water-throwing habit of fishes in the New York Aquarium. Bull. N. Y. Zool. Soc., 1909, 488. Add. 1909.1

Townsend, C. H.

— The conservation of our rivers and lakes. Trans. Amer. Fisheries Soc. 1910 (1911), 101–114.

Add. 1911.1

— The curious relationship of the freshwater mussel to fishes. Bull. N. Y. Zool. Soc., 1913, **16**, 1046.

Add. 1913.1

— Destruction of fishes by algæ. Bull. N. Y. Zool. Soc., 1913, **16**, 1048.

Add. 1913.2

— A fine herd of sea horses [at the New York Aquarium] Bull. N. Y. Zool. Soc., 1913, **16**, 1058. fig.

Add. 1913.3

— Hatching grayling at the [New York] Aquarium. Bull. N. Y. Zool. Soc., 1913, **16**, 1056–1057.

Add. 1913.4

— A long-lived fish. Bull. N. Y. Zool. Soc., 1913, **16**, 1049. fig.

Add. 1913.5

A striped bass [*Roccus lineatus*] twenty-one years old.

— Notes of interest [on various fishes] Bull. N. Y. Zool. Soc., 1913, **16**, 1055–1056. figs.

Add. 1913.6

— The private fish pond — a neglected resource. Bull. N. Y. Zool. Soc., 1913, **16**, 1053–1054.

Add. 1913.7

For full paper see Townsend, 1914.1.

— The scarcity of literature on the habits of fishes. Bull. N. Y. Zool. Soc., 1913, **16**, 1042–1043.

Add. 1913.8

— The whale shark [*Rhineodon typus*] Bull. N. Y. Zool. Soc., 1913, **16**, 1047–1048, 2 figs.

Add. 1913.9

— Biological investigations in Long Island Sound. Bull. N. Y. Zool. Soc., 1914, **17**, 1161–1163.

Add. 1914.1

— An interesting fish photograph. Bull. N. Y. Zool. Soc., 1914, **17**, 1178.

Add. 1914.2

The spotted horse, *Equus punctatus*.

— New aquariums in America and Europe. Bull. N. Y. Zool. Soc., 1914, **17**, 1093–1094. 2 figs.

Add. 1914.3

Trachmann, Charles O. Voracity of the haddock [*Gadus aeglefinus*] Nature, 1889, **39**, 9.

Add. 1889.1

Tracy, H. C. The fishes of Rhode Island. III. The fishes of the mackerel family. 37. Ann. Rept. Comm. Inland Fisheries Rhode Island, 1907, 33–64. 8 figs.

Add. 1907.1

— A list of rare fishes taken in Rhode Island in the year 1906. 37. Ann. Rept. Comm. Inland Fisheries Rhode Island, 1907, 65–68.

Add. 1907.2

— The fishes of Rhode Island. V. The flatfishes. 38. Ann. Rept. Comm. Inland Fisheries, Rhode Island, 1908, 46–84. 9 figs.

Add. 1908.1

— The fishes of Rhode Island. VI. A description of two young specimens of squeteague (*Cynoscion regalis*) with notes on their rate of growth. 38. Ann. Rept. Comm. Inland Fisheries, Rhode Island, 1908, 85–91. 2 figs.

Add. 1908.2

— The fishes of Rhode Island. VII. The life history of the common eel. 39. Ann. Rept. Comm. Inland Fisheries Rhode Island, 1909, 43–55. 2 pls.

Add. 1909.1

Traquair, Ramsay Heatley [1840–1912] For biographical sketches and obituaries, see Hussakof, L. 1913.2. See also McIntosh, W. C. in Zoologist, 1912, 4. ser. **16**, 464–466; Scottish Nat., 1913, p. 5; Horne, J. in Proc. Roy. Soc. Edinburgh, 1914, **33**, 336–341.

— History of research among the fossil fishes of Scotland. Nature, 1879–80 (1880), **21**, 428–431.

Add. 1880.1

— The platysomid fishes. Nature, 1879–80 (1880), **21**, 55.

Add. 1880.2

— Notes on *Chondrosteus acipenseroides*, Agassiz, Proc. Roy. Phys. Soc. Edinburgh, 1885–88 (1888), **9**, 349–361. 5 figs.

Add. 1888.1

Traube-Mengarini, Margherita. Recherches sur les gaz contenus dans la vessie natatoire des poissons. Arch. Ital. Biol., 1888, **9**, 248–254.

Add. 1888.1

Carassius auratus and *Leuciscus* studied.

Treacher, W. H. British Borneo: sketches of Brunei, Sarawak, Labuan and North Borneo. Journ. Straits Branch Roy. Asiatic Soc., 1889, no. 20, 13–74.

Add. 1889.1

Fishing methods; wiers, nets, spears, tuba; p. 52–55.

Tristram, H. B. Fish and fishing (In Smith, (Sir) William, & Fuller, J. M. A dictionary of the Bible, comprising its . . . natural history. 2 vols. (A.—Juttot). London, 1893, 1073–1076. 4 figs.) Add. 1893.1

Many earlier and less valuable editions.

Trois, Enrico F. Considerazioni sul *Dentex gibbosus*. Atti Reale Instit. Veneto Sci. Lett., Arti, 1886, 6. ser. 5, 1–6. Add. 1886.1

— Catalogo delle collezioni d'anatomia comparata del r. Istituto Veneto di Scienze Lettere ed Arti (1867–1900). Atti Reale Inst. Veneto Sci. Lett., Arti, 1899–1900 (1900), 59 (pt. 1), 63–261. Add. 1900.1

Anatomical preparations of fishes are included.

Trojan, Emanuel. Ein Myxobolus im Auge von *Leuciscus rutilus*. Zool. Anz., Leipzig, 1909, 34, 679–682. 3 figs. Abstract in Zool. Centralb., Leipzig, 1909, 16, 697. Add. 1909.1

True, Frederick William. Worms in fish. Forest & Stream, New York, 1881, 16, 390. — Amer. Journ. Micros., New York, 1881, 6, 206. Add. 1881.1

Trumbull, J. Hammond, & Joselyn, John. Etymology of the names of the menhaden. Rept. U. S. Fish Comm. 1877 (1879), 5, 11. Add. 1879.1

Trybom, Filip. Jakttagelser om fisk och dekapoder från Skagerack och Kattegat i Augusti 1901 och Februari 1902 samt från Oestersjön i Oktober 1901. Svensk. Hydrog. Biol. Komm., Skrifter I, Göteborg, 1903. Add. 1903.1

Observations on fish and decapods, from Skagerack and Kattegat in August, 1901 and February, 1902; also from the Baltic in October, 1901.

Tryon, G. W., & Binney, W. G. See Binney, & Tryon.

Tscheiner, D. J. Die wohlerfahrene Fischermeister oder ausführlicher Unterricht in der gesamten Angel- und Netzfischerey und dem Krebse- und Fröscheffang. Pesth, 1821. xii, 244 p. 24 pls. 8°. Add. 1821.1

Tsuchida, Toshizo. Preservation and casting of the specimens of fishes [Text in Japanese] Gyogaku Zasshi [Journ. Ichthyol.] 1914, 1, no. 1, 5–8. Add. 1914.1

Tulian, E. A. Five years' progress in fish-culture in Argentina. Trans. Amer. Fisheries Soc. 1910 (1911), 415–422. Add. 1911.1

Turner, G. Official guide [to the Great International Fisheries Exhibition, 1883] London, 1883. 60 p. illust. 16°. Add. 1883.1

Turner, William, & Wilson, S. H. On the structure of the *Chondracanthus lophii*, with observations on its larval form. Trans. Roy. Soc. Edinburgh, 1861–64 (1864), 23, 67–76. 16 figs. Add. 1864.1

Crustacean parasite of *Lophius*.

Turpin, —. Histoire naturelle et civile du Royaume de Siam. 2 vols. Paris, 1771. 12°. Add. 1771.1

Many fishes of Siam named, and uses indicated.

Tarrantine, J. W. The fish-scrap fertilizer industry of the Atlantic coast. U. S. Dept. Agr. 1913, bull. no. 2, 1–50. 6 pls. Add. 1913.1

Tye, George Sherriff [—1900] Fishes and mollusca. (In Handbook of Birmingham. Prepared for the members of the Brit. Assoc. Advanc. Sci. 1886. Birmingham, 1886. xxi, 378 p. map. 8°. Part iv, Zoology.) Add. 1886.1

Tyzzar, E. E. Tumors and sporozoa in fishes. Journ. Boston Soc. Med. Sci., 1900, 5, 63–68. 1 pl. Add. 1900.1

U

Ulloa, Antonio de [1716–1795] *Noticias Americanas: Entretenimientos physicos-historicos sobre la America Meridional, y la Septentrional Oriental* [etc.] Madrid, 1772. 407 p. Add. 1772.1

Sobre las pescados particulares, p. 161–174.
Ciguatera (fish poisoning), p. 170–171.

A German version is entitled:

— *Physicalisch-historische Nachrichten vom südlichen und nordöstlichen Amerika.* Leipsic, 1781.

Add. 1781.1

Umlauff, H. *Der Molchfisch (Protopterus annectens).* Blätt. Aquar.-Terrar. Kunde, 1895, 6. Jahrg. 185.

Add. 1895.1

Ungerer, — *Die Fischerzunft in Illhäusern.* Jahresber. Elsässischen Fischerei Ver. 1911 (1912), 63–78.

Add. 1912.1

V

V., H. *De zwemblass der visschen.* Tijdschr. Vereen. Nederl. Zeewezen, 1905, 4. jaarg., 254. Add. 1905.1

Vachell, Horace Annesley. *Life and sport on the Pacific slope.* New York, 1901. 393 p. illust. Add. 1901.1

Sea fishing, 307–334; fresh-water fishing, 335–344.

Vaillant, Léon Louis [1834–1915] *Remarques sur la disposition fondamentale des teintes chez un Echeueis vivant.* Bull. Soc. Philomath. Paris, 1883–84 (1884), 7. ser. 8, 5–7.

Add. 1884.1

— *Sur les espèces qui composent le genre Plesiops.* Bull. Soc. Philomath. Paris, 1888, 8. sér. 1, 57–60. Add. 1888.1

— *Sur un genre nouveau (Neopercis) pour la faune ichthyologique de l'Atlantique.* Bull. Soc. Philomath. Paris, 1887–88 (1888), 7. ser. 12, 7–.

Add. 1888.2

Vaillant, Léon, & Pellegrin, J. *Poissons (en Khroumirie) (In Gadeau de Kerville, Henri. Voyage zoologique en Khroumirie (Tunisie) mai-juin, 1906.* Paris, 1908. xviii, 316 p. illust. 8°.)

Add. 1908.1

Poissons (3 species), p. 93.

Valenciennes, Achille [1794–1865] *Nouvelles observations sur le Capitan*

de Bogota, *Eremophilus mutisii* . . . (In Humboldt, F., & Bonpland, A. *Voyage aux régions équinoxiales du nouveau continent fait en 1799–1804*, pt. II, vol. ii, no. 10. Paris, 1811. 4° & fol.)

Add. 1811.1

— *Poissons fossiles.* Trans. Geol. Soc., 1829, 3.

Add. 1829.1

Osteolepis macrolepidotus, n. g., n. sp.

— *Ichthyologie.* (In Du Petit-Thouars, A. *Voyage autour du monde sur . . . la Vénus, pendant . . . 1836–39.* Zoologie, Paris, 1855. 355 p. 79 pls. atlas. 8° & fol.)

Add. 1855.1

— *Rapport sur les collections . . . de mammifères . . . recueillis par M. Albert Gaudry, à Pikermi, près d'Athènes, etc.* C. R. Acad. Sci. Paris, 1861, 52, 1295–1300.

Add. 1861.1

Describes *Acanthomullus isabellæ* n. g. et n. sp., p. 1300, (Smerdis), Miocene of Koumi, Eubœa.

Valkenberg, C. T. van. *Over meniscefaie kern en wortel van den nervus trigeminus.* Versl. K. Acad. Wet. Amsterdam, 1911, 19, pt. 2, 1352–1370.

Add. 1911.1

Van Doren, J. B. J. *Herinneringen en Schetzen van Nederland's Oost Indien.* Amsterdam, 1858. Add. 1858.1

Native names of fishes of Sangir islands.

Van Dyke, John C. The opal sea. New York, 1906. Add. 1906.1

"Dwellers in the deep," p. 202-222.

Varpakhovskii, Nikolai Arkadevich [1862—] Eine neue Phoxinus-Art. Zool. Anz., 1886, 9, 76. Add. 1886.1

— Die Süßwasserfische des europäischen Russland (Text in Russian) St. Petersburg, 1898. 102 figs. 8°. Add. 1898.1

Vasilyeff, S. M., & Mochaloff, M. I. Study of fish poisons (Text in Russian) Novosti Vet. Lit., St. Petersburg, 1885, 2, no. 3, 1-6. Add. 1885.1

Vauquelin, Louis Nicholas. Analyse der Eier des Hechtes. Deutsches Archiv. Physiol. (Meckel), 1818, 4, 608. Add. 1818.1

Translation of Vauquelin, L. N., 1817.1.

Vávra, Vélav. O vejcich žraločich (Egg cases of sharks, rays and chimæra) Vesmir, Prague, 1901, 30, 184. 4 figs. Add. 1901.1

Verissimo, José. A pesca do pirarucu. A pesca na Amazonia. Monographias Brasileiras, 1895. Add. 1895.1
Breeding habits of *Arapaima gigas*, p. 37-40.

Verneuil, E. de, Keyserling, A. de, & Murchison, R. I. See **Murchison, Verneuil, & Keyserling.**

Vicq-d'Azyr, Félix. De la structure de l'organe de l'ouie des oiseaux, comparé avec celui de l'homme, des quadrupèdes, des reptiles et des poissons. Mém. Acad. Sci. Paris, 1778 (1781), 381-392. 2 pls. Add. 1781.1

Correct citation for Vicq-d'Azyr, 1777.1.

— Sur la structure du cerveau des animaux comparée avec celui de l'homme. Mém. Acad. Sci. Paris, 1783 (1786), 468-504. 4 pls. Add. 1786.1
Fishes, p. 473-475; 477-504. 2 pls.

Victorini, Wenz. Max. Wie man die Weyher benutzen und die Karpfen auf Böhmische Weise erziehen könne. Abh. Churf. Baierschen Akad., c. 1775, 9, no. 1. Add. 1775.1

Vignon, Georges Contribution à l'étude des intoxications alimentaire produites par les poisson. Paris, 1902.1 94 p. Add. 1902.1
Medical Thesis, Paris.

Vigueron, H. La vision dans l'eau. La Nature, 1913, 42. ann., 1. sem., 8-10. 7 figs. Add. 1913.1

Villeneuve, —. Von den Ohren des Seepferdes. Hamburg. Mag. 1760, 24, 598-604. Add. 1760.1

See also in Pre-Linn. section, 1756.1.

Vincent, Harry. The sea fish of Trinidad. Port of Spain, 1910. 97 p. figs. Add. 1910.1

Vincent, Swale. Comparative physiology of the suprarenal capsules. Proc. Roy. Soc. London, 1897, 61, 64-72. Add. 1897.1

Effects on other animals of suprarenal extracts of elasmobranch and teleost fishes.

Vincenzio di Eugenio, Voltolina. Osservazione intorno alla semina delle anguilline nelle valli Salse. Neptunia, Venezia, 1902, 17, 174-176. Add. 1902.1

— L'industria valliva moderna nel Tenimento di Mesola (Pisciculture) Neptunia, Venezia, 1903, 18, 261-264. Add. 1903.1

Virchow, Hans. Ueber Fischeaugen. Sitzber. Phys. Med. Ges. Würzburg, 1881, 108. Add. 1881.1

— Dottersyncytium, Keimhautrand, und Beziehung zur Konkreszenzlehre. Ergeb. Anat. Entwickl., 1897, 7, 594-651. Add. 1897.1

Work done on elasmobranch and teleost eggs.

— Erklärung gegen die Herren Whitman und Eycleshymer. Anat. Anz., Jena, 1897, 13, 271-278. Add. 1897.2

Reply to Whitman's strictures on Füllerborn's work on *Amia calva*.

— Fächer, Zapfen, Leiste, Polster, Gefässe im Glaskörperraum von Wirbeltieren sowie damit in Verbindung stehende Fragen. Ergeb. Anat. Entwickl., 1900, 10, 720-844. Add. 1900.1

Linsenmuskel und gefäseführende Leiste der Fische, p. 799-818.

Vogel, P. Neues illustriertes Lehrbuch der Teichwirtschaft. Spezialwerk über Karpfen-, Schleien-, und Forellenzucht in Teichen. Bautzen, 1913. 656 p. 9 pls. text-figs. 8°. Add. 1913.1

Voigt, Friederich Sigismund [1781-1850] System der Natur und ihre Geschichte. Jena, 1823. xii, 866 p. 8°. Add. 1823.1

— (translator) Das Thierreich, geordnet nach seiner Organisation . . .

Voigt, F. S.

Nach der zweiten . . . Ausgabe übersetzt und durch Zusätze erweitert von F. S. Voigt. 6 vols. Leipzig, 1831-43. Add. 1831.1

This is a translation of Cuvier's "Règne animal" with annotations by the translator.

Volta, Giovanni Serafino. Degl' impietrimenti del territorio Veronese, etc. Lettera al Sig. Vincenzo Bozza, 1789. Add. 1789.1

100 Monte Bolca fishes listed.

— Saggio filosofico critico sul vero elemento vitale che respirano i pesci. Mantova, 1838. 8°. Add. 1838.1

Voskoboynikov, M. Studien zur Kenntniss der Branchiomerie der Wirbeltiere. I, II [Text in Russian] Mem. Soc. Nat. Kiev, 1914, 24, no. 1, 1-176. Add. 1914.1

Résumé in German, 177-178.

Vrolik, —. Lettre à l'occasion d'une communication de M. de Quatrefages sur la formation des monstres doubles chez les poissons. C. R. Acad. Sci. Paris, 1855, 40, 2 sem., 970-971. Add. 1855.1

Vutskits, George. The following titles, supplied by the author, have the text in Hungarian. He has given German translations for the convenience of the reader.

— Daten zur Fischfauna des Plattensees. Pötfuz. Termész. Közl., Budapest, 1895, 34, 109-113. Add. 1895.1

— Daten zur Fischfauna des Plattensees und der Thermen von Hérisz. Pötfuz. Termész. Közl. [Ergänzungshft. Naturw. Mittheil.], Budapest, 1895, 16-18. Add. 1895.2

— Ueber das Vorkommen des *Lucioperca volgensis* und *Abramis balerus* im Plattensee. Pötfuz. Termész. Közl., 1896, 36, 5-8. Add. 1896.1

— Alampetische und monstrose Fische im Plattensee. Pötfuz. Termész. Közl., 1897, 40, 36-39. fig. Add. 1897.1

— Daten zur Fischfauna des Plattensees — Das Vorkommen des *Leucaspis delineatus* im Plattensee. Term. Közl., 1897, 29, 231-233. Add. 1897.2

— Der Kukukfisch (*Rhodeus amarus*) A Termész. (Die Natur), Budapest, 1897-98, 1, 4-7. 2 figs. Add. 1897.3

— Plattensee Indigänen (*Gobius marmoratus* und *Pelecus cultratus*) A Termész. 1897-98, 2, 2-6. 2 figs. Add. 1897.4

— Ueber die Häufigkeit der einzelnen Fischarten des Plattensees. Term. Közl. [Naturw. Mittheil.], Budapest, 1897, 593-595. Add. 1897.5

— Das Leben der Fische in den einzelnen Monaten des Jahres. A Termész. 1899. Add. 1899.1

— Aus dem Eheleben der Fische. A Termész. 1900-01, 4 (Fischerei 2), 238-240. Add. 1900.1

— Aus dem Familienleben der Fische. A Termész. 1900-01, 4 (Fischerei 2), 68-71. Add. 1900.2

— Die Fischfauna Kroatien's. A Termész. 1900-01, 4 (Fischerei 2), 133-135. 2 figs. Add. 1900.3

— Forellenfang. A Termész. 1902-03, 6, 3-6. Add. 1902.1

— Von Tieren protegirte Fische. A Termész. 1902-03, 6, 3-6. fig. Add. 1902.2

— Die Fischfauna Ungarns. A Termész. 1903-04, 8, 266-283. Add. 1903.1

— Der Kampf mit einem Welse. A Termész. 1903-04, 8, 182-184. Add. 1903.2

— Das Leben der Torfmoore. A Termész. 1903-04, 7, 13-16. 3 figs. Add. 1903.3

— Ueber die Fischfeinde *Lerneocera cyprinacea* und *L. esocina* Burm. Halászat [Fischerei], Budapest, 1903-04, 5, 110-111; 116-117. 3 figs. Add. 1903.4

— Vaterländische Lernæopodinen, *Trachelistes maculatus*. Halászat, 1903-04, 5, 174-176. Add. 1903.5

— Wasserzuchtige Plattenseefische. A Termész. 1903-04, 8, 121-124. fig. Add. 1903.6

— Blinde Fische. Halászat, 1904-05, 6, 123-125. Add. 1904.1

— Der Fisch auf dem Tische der Alten. A Termész. 1904-05, 8, 278-280. Add. 1904.2

— Die Fischfauna Ungarns. A Termész. 1904-05, 8, 11-14. Add. 1904.3

- Der Hecht, *Esox lucius*. Halászat, 1904-05, 6, 58-60; 66-68. Add. 1904.4
- Der Karpfen. Halászat, 1904-05, 6, 138-140. Add. 1904.5
- Die Laichzeit und die Laichstette des Plattensee Schiels. *Lucio-perca sandra*. Halászat, 1904-05, 6, 75-76; 85-86. Add. 1904.6
- Der Rapfen oder Schied. Halászat, 1904-05, 6, 166-167. Add. 1904.7
- Was verfertigt man Alles aus den Fischen. A Természet, 1904-05, 8, 206-208. Add. 1904.8
- Der Wels (*Silurus glanis*) Halászat, 1904-05, 6, 34-35. Add. 1904.9
- Zur Frage der Plattenseefischerei. Halászat, 1904-05, 6, 106-109; 114-115. Add. 1904.10
- Die Farbe der Fische. Halászat, 1905-06, 7, 106-107; 114-116. Add. 1905.1
- Fischhybriden und Fischzucht. Halászat, 1905-06, 7, 141-143. Add. 1905.2
- Freundschaft und Feindschaft zwischen den Fischen. Halászat, 1905-06, 7, 2-4. Add. 1905.3
- Giftige Fische. Halászat, 1905-06, 7, 26-29. Add. 1905.4
- Die giftigen Fische unseres Vaterlandes. Halászat, 1905-06, 7, 52-54. Add. 1905.5
- Die Raubfische des Plattensees. Halászat, 1905-06, 7, 178-181. Add. 1905.6
- Die Bewegungsorgane der Fische. Halászat, 1906-1907, 8, 134-141. Add. 1906.1
- Hören die Fische oder nicht? Halászat, 1906-07, 8, 76-78. Add. 1906.2
- Der Sichling (*Pelecus cultratus*) Halászat, 1906-07, 8, 36-38. Add. 1906.3
- Die Sinnorgane der Fische. Halászat, 1906-07, 8, 105-106. Add. 1906.4
- Fischkrankheiten im Plattensee. Halászat, 1907-08, 9, 145-146. fig. Add. 1907.1
- Giftige Fische. Halászat, 1907-08, 9, 91-92. Add. 1907.2
- Die Krankheiten der Fische-skelete. Halászat, 1907-08, 9, 17-19. 3 figs. Add. 1907.3
- Die Rekonstruktionsfähigkeit der Fische. Halászat, 1907-08, 9, 52-53. fig. Add. 1907.4
- Geschwülstige und Schuppentreibige Plattenseefische. Halászat, 1908-09, 10, 117-119. fig. Add. 1908.1
- Ueber das Gedächtniss der Fische. Halászat, 1908-09, 10, 5-6. Add. 1908.2
- Was wusten die Alten von den Fischen und von der Fischerei. Halászat, 1908-09, 10, 183-188. Add. 1908.3
- Interessante Daten über die Fischzucht des *Micropterus salmoides* und *Eupomotis aureus*. Halászat, 1909-10, 11, 60-61. Add. 1909.1
- Richtige und falsche Observationen aus dem Leben unserer Süßwasserfische. Halászat, 1909-10, 11, 3-32. Add. 1909.2
- Neuere biologische Daten über unsere Süßwasserfische. Halászat, 1910-11, 12, 115-181. Add. 1910.1
- Ueber die Fischbastarde. Halászat, 1910-11, 12, 25-53. Add. 1910.2
- Unsere vaterländischen Acipenseriden. Halászat, 1910-11, 13, 41-69. Add. 1910.3
- Das Einheimischwerden des amerikanischen Sonnenfisches im Plattensee. Term. Közlany, 1912, 44, 467-468. Add. 1912.1
- Die Tierwelt Ungarns Fische 1913. Fauna regni Hungariæ. Pisces [Text in Hungarian and Latin] Budapest, 1913. 24 p. Add. 1913.1
- Zwei kranke Plattenseefische — Eierstockcyste und Skolioze. Halászat, 1913, 14, 7-8, 2 figs. Add. 1913.2

W

Waagen, William. Salt-range fossils. Productus limestone fossils: Pisces. [Carboniferous of Punjab, India.] Palæont. Indica, 1880, 13. ser. 1, 9-20. suppl., 73-81. Add. 1880.1

Wagner, Christian. Die Goldfischzucht von Christian Wagner zu Oldenburg. Deutsche Fischerei Zeitg., 1879, 2. Jahrg., no. 29. — Rept. U. S. Fish Comm. 1878 (1880), 6, 679-684. Add. 1879.1

Wakeham, William, & Rathbun, Richard. See **Rathbun & Wakeham.**

Walbaum, Johann Julius [1724-1799] Von dem Schwerd- oder Sägefische des Herrn Bauder. Schröters Journ. Liebhaber Steinreiches Conchyologie, 1774, 1, 312. *Ibid.*, 2, 376. Add. 1774.1

—— Beschreibung und Abbildung der Seelerche. *Blenn. gallerita*. Berlin. Samml., 1775, 7, 128. Add. 1775.1

—— Beschreibung der Neunaugen, sonderlich nach ihren innerlichen Theilen. Wittenberg. Wochenbl. 1778, 11, 113. Add. 1778.1

—— Beschreibung eines Schwerdfisches. Lübecker Anz., 1778, 47. St. — Allerneueste Mannichfalt., 2 Jahrg., 202. — Berlin. Samml., 1779, 10, 70-80. Add. 1778.2

—— Beschreibung des Brillenträgers, *Tetrodon conspicillum* L. Hannöv. Mag., 1779, 1578. Add. 1779.1

—— Der Soldatenfisch, *Chætodon capistratus*. Hannöv. Mag., 1779, 1570. Add. 1779.2

—— Von den verschiedenen Sorten des Herings und deren Benennungen in Norwegen. Hannöv. Mag., 1780, 1079. Add. 1780.1

—— Beschreibung der Hamburger Scholle (i. e. *Pleuronectes platessa*). Hannöv. Mag., 1781, 1003, 1009. Add. 1781.1

—— Beschreibung der Meerneunaugen, *Petromyzon marinus*. Allerneueste Mannichfalt., 1783, 2. Jahrg. 433. Add. 1783.1

—— Beschreibung des Butterfisches, *Blennius gunellus*. Allerneueste Mannichfalt., 1783, 2. Jahrg., 444. Add. 1783.2

—— Beschreibung eines Stücks von einem versteinerten Horn eines Sägefisches. Schrift. Ges. Naturf. Freunde Berlin, 1784, 9, 477-478. Add. 1784.1

Walcott, Allen M. Ray-skin rasps. Occas. Papers Bernice Pauahi Bishop Mus., Honolulu, 1900, 1, 32-33. Add. 1900.1

Waldeyer, W. Die Geschlechtszellen. (In Hertwig, O. Handbuch Entwicklungslehre der Wirbeltiere, Jena, 1906, 1, pt. 1.) Add. 1901.1
This paper was published in 1901. Fishes, p. 118-124, 9 figs.; 293-310, 16 figs.; 376-379.

Walentowicz, A. Karpfenpest in Kaniów. Oesterr. Vrtljschr. Wiss. Veterinärk., Wien, 1885, 64, 193-200. Add. 1885.1

Walheim, —. Address on the fisheries of Norway. Trans. Amer. Fish-culturists' Assoc., 1876-77 (1877), 95-100. Add. 1877.1

Walker, H. Wilfrid. Wanderings among the South Sea savages and in Borneo and the Philippines. London, 1910. Add. 1910.1

Many notes on fish and fishing. Illustration of fishing with tuba root to face p. 213.

Wallace, Alfred Russel [1823-1913] My life — a record of events and opinions. 2 vols. London, 1905. 435 & 459 p. Add. 1905.1

Fishes of the Rio Negro, pp. 285-286. 3 pls. About 200 figures of fishes were drawn, but only 6 published. See also Regan, C. T., 1905.9.

Wallem, Frederik M. Den internationalen fiskeriudstilling i Berlin 1880. Bergen, 1881. map. Add. 1881.1

—— Den internationalen Fiskeriudstilling i London, 1883. Bergen, 1885. pls. Add. 1885.1

Waller, Horace (editor) The last journals of David Livingstone in cen-

tral Africa from 1865 to his death. New York, 1875. Add. 1875.1

An American ed. of the London, 1874, ed.
See also Livingstone, D., Add. 1875.1

Wallich, George Charles [1815-1899]
The structure and habits of Physalia.
Intell. Obs. 1862-63 (1863), 2, 362-368.
Add. 1863.1

Symbiosis of Physalia and fish.

— On Physalia and certain scom-
broid (?) fish which are frequently
associated with it in tropical and sub-
tropical seas. Ann. Mag. Nat. Hist.,
1869, 4. ser. 3, 8-10. Add. 1869.1

Wallner, Julius. Beiträge zur Ge-
schichte des Fischereiwesens in der
Steiermark. I. Teil, Das Gebiet von
Aussee. Graz & Wien, 1911. 134 p. —
Abstract by Dr. J. Schultze in Arch.
Fischereigesch., 1913, Heft 1, 207-209.
Add. 1911.1

Walpole, Spencer. The fish supply
of London. Journ. Soc. Arts, 1882, 30,
711-721. Add. 1882.1

Walpole, S., & Buckland, F. See
Buckland & Walpole.

Walpole, S., & Huxley, T. H.
Disease among the salmon of many
rivers in England and Wales. 21. Ann.
Rept. Inspector Fisheries (England and
Wales), 1881 (1882). Add. 1882.1
Original title for Walpole, S., & Huxley,
T. H., 1882.1

Walsh, John. Lettre à M. Franklin
(concerning Torpedo) Obs. Phys. Nat.
Hist. et Arts., 1774, 4, 206-219.
Add. 1774.1

Walter, E. Das Kiemenfilter der
Süßwasserfische. Neudammer Fische-
rei Zeitg., 1903, 6, no. 49.
Add. 1903.1

Ward, Henry Baldwin. The food
supply of the Great Lakes; and some
experiments on its amount and dis-
tribution. Trans. Amer. Micr. Soc.,
1896, 17, 242-254. 2 pls. Add. 1896.1

— A plea for the study of limno-
biology. Trans. Amer. Micros. Soc.,
1899 (1900), 21, 201-212. Add. 1900.1

Ward, Thomas. Rambles of an Aus-
tralian naturalist (Edited by Paul
Fountain) London & New York, 1907.
343 p. Add. 1907.1

Fishes, p. 50; 125-126; 138; 155; 173; 203-
205; 209-210; 242; 277; 309-315.

Warington, Robert. Observations
on the natural history of the water-
snail and fish [*Gasterosteus leiurus*] kept
in confined and limited portion of water.
Ann. Mag. Nat. Hist., 1852, 2. ser. 10,
273-280. Add. 1852.1

For continuation see Warington, R. 1855.1.

Warren, Andrew F. The red-snapper
fisheries; their past, present and future.
Bull. U. S. Fish Comm. 1897 (1898),
17, 331-335. Add. 1898.1

Wasson, Samuel. Survey of Han-
cock county (Maine) Ann. Repts.
Agric. Soc. Maine, 1877-78 (In 22.
Ann. Rept. Maine Board Agric. 1877
(1878)) Add. 1878.1

Fisheries, p. 220-225.

Watson, E. E., & Kofoed, C. A. See
Kofoed & Watson.

Watterbled, —. Notice sur les
poissons migrateurs de l'Allier. Actes
Soc. Linn. Bordeaux, 1882, 4. sér. 6 (36),
xxii. Add. 1882.1

Watson, J. Sketches of British
sporting fishes. London, 1890. 143 p.
8°. Add. 1890.1

Watson, John B. Behavior: an in-
troduction to comparative psychology.
New York, 1914. 12°. Add. 1914.1

Instincts of fish, 122-124. Motor habits of
fish, 192-195. Spectral range, 341. Sensitivity
to wave lengths, 353. Auditory response, 389-
396. Sense of smell, 407-412. Taste, 412-415.
Common chemical sense, 415-419. Contact
sensitivity, 427.

Wawn, W. T. The South sea is-
landers, etc. London, 1893. 440 p.
illust. Add. 1893.1

Various methods of fishing illustrated, p. 316-
338; 413; with the kite, p. 327.

Way, E. Fish slime disease. Journ.
Amer. Med. Assoc., Chicago, 1897, 28,
1015. Add. 1897.1

Weber, Ernst H. De aure et auditu
hominis et animalium. Pars. I. De
aure animalium aquatiliu, &c. Lip-
siæ, 1820. 34, 134 p. 10 pls. 4°. Ab-
stracts in Bull. Soc. Philom., 1821, 118.
— Isis, 1821, col. 1059. Add. 1820.1

Petromyzon, Cyprinus, Tinca, *Silurus glanis*,
Cobitis (2 sp.), Sparus, Clupea, Torpedo, Raja,
Carcharias.

Weeger, Emil. Die Aufzucht der
Forelle und der anderen Salmoniden.
2. ed. Wien, 1892. 38 p. Add. 1892.1

Wehberg, Hans. Streitigkeiten über
die Neufundlandfischerei. Deutsch.

Wehberg, H.

Fischerei Zeitg., 1913, 36. Jahrg., 71-73; 93-94. Add. 1913.1

Wehrmann, C. Recherches sur les propriétés toxiques et antitoxiques du sang et de la bile des anguilles et des vipères. Ann. Inst. Pasteur, 1897, 11, 810-828. Add. 1897.1

Weigelt, Curt. Neue Beiträge zur Frage der Schädlichkeit von Fabrick- und Hausabwässern für Fischzucht und Fischhaltung. Tagebl. Vers. Deutsch. Naturf. Aerzte., Salzburg, 1881, 54, pt. 2, 88-91. Add. 1881.1

Weigold, — Zu "Verpflanzung von Schollen nach der Doggerbank." Deutsche Fischerei Zeitg., 1911, 34. Jahrg., 32. Add. 1911.1

Weiss, Frederick Ernest. Excretory tubules in *Amphioxus lanceolatus*. Quart. Journ. Micr. Sci., 1890, 31, 489-497. 2 pls. Add. 1890.1

Weiss, O. Die Erzeugung von Geräuschen und Tönen. (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. III, Hälfte 1, Theil 1, p. 249-318. 18 figs. Jena, 1914). Add. 1914.1

Lautäusserungen der Fische, p. 305-311.

Wells, Morris M. The reactions and resistance of fishes to temperature. Trans. Ill. Acad. Sci., 1914, 7, 48-59. Add. 1914.1

Wells, William V. Explorations and adventures in Honduras, etc. New York, 1857. 588 p. illust. Add. 1857.1

Scattering notes of small value on fish and fishing, p. 35; 143; 212-213; 356; 368. Fishing with the chilpate (*Sapindus saponaria*), p. 417-418.

Welsh, W. W. List of fishes (In Bigelow, H. B. Explorations in the gulf of Maine. Bull. Mus. Comp. Zool. Harvard Coll., 1914, 58, 107-114). Add. 1914.1

Weltner, W. Ueber einen Ekto-parasiten unserer Weissfische (*Diplostomum cuticola*). Blätt. Aquar.-Terrar. Freunde, 1889, 10, Jahrg., 51-53. 2 figs. Add. 1889.1

— Zur Untersuchungen von Fischkrankheiten. Blätt. Aquar.-Terrar. Freunde, 1894, 5. Jahrg. 169-172. Add. 1894.1

— Die Ichthyophthirius-Krankheit. Blätt. Aquar.-Terrar. Freunde, 1895, 6. Jahrg. 8 p. 8 figs. Add. 1895.1

— Der afrikanische Molch- oder Schlammfisch, *Protopterus annectens* Ow. Blätt. Aquar.-Terrar. Freunde, 1896, 7. Jahrg. 220. Add. 1896.1

Weltner, W., & Nitsche, P. See Nitsche & Weltner.

Wergeland, N. Vore indsoers og elves statsöconomiske vaerd, som teldt for fiskeavl. Meddel. Norsk Jager & Fisker-Forening, Christiania, 1878, 7. Jahrg., 1-47; 101-172. Add. 1878.1

The economic values of lakes and rivers as suitable places for fish-culture. See also Wergeland, N. 1880.1 & 1880.2

Werlosching, Johannes Baptista. Besondere Verordnungen die Fische-reyen betreffend. Fränkische Samml., 1760, 5, 430. Add. 1760.1

Wernicke, O. La vision en los pescados. An. Circ. Méd. Argent., Buenos Aires, 1895, 15, 49-54. Add. 1895.1

Wetherill, Charles. Fish culture by land owners. Rept. Comm. Fisheries State of Pennsylvania, 1900 (1901), 152-158. pl. Add. 1901.1

Weyl, Theodor. Die Säulenzahl im elektrischen Organ von *Torpedo oculata*. Centralb. Med. Wiss., Berlin, 1882, 20, 273-277. Add. 1882.1

— Physiologische und chemische Studien von *Torpedo*. Zeitschr. Physiol. Chem., 1883, 7, 541-552. *Ibid.*, 1887, 11, 525-528. Add. 1883.1

See also Weyl, Th., 1883.1

Whitaker, Herschel. Early history of the fisheries of the Great Lakes. Trans. Amer. Fisheries Soc., 1892, 163-179. Add. 1892.1

See also Whitaker, H., 1893.1

— Some observations on the moral phases of modern fish-culture. Trans. Amer. Fisheries Soc. 1895 (1896), 59-74. Add. 1896.1

White, G. F. The properties and utilization of some marine animal oils. Trans. Amer. Fisheries Soc., 1914, 43, 79-91. Add. 1914.1

White, Gertrude Marian. Association and color discrimination in mud-minnows and sticklebacks. Journ. Exp. Zool., 1919, 27, 443-498. 10 figs. Add. 1919.1

Whiteaves, J. F. Notes on a deep-sea dredging expedition around the

island of Anticosti in the gulf of St. Lawrence. Canadian Natural. & Quart. Journ. Sci., 1872, n. s. 7, 86-100.

Add. 1872.1

— Report on a second deep-sea dredging expedition to the gulf of St. Lawrence, with some remarks on the marine fisheries of the province of Quebec. Ann. Rept. Dept. Mar. Fisheries 1872 (1873), Fisheries Branch, append. K, 113-132.

Add. 1873.1

— Report on further deep-sea dredging operations in the gulf of St. Lawrence, with notes on the present condition of the marine fisheries and oyster beds of part of that region. 6. Ann. Rept. Dept. Mar. Fisheries 1873 (1874), Fisheries Branch, append. U, 178-206.

Add. 1874.1

Whympers, Edward. Travels amongst the great Andes of the equator. New York, 1892.

Add. 1892.1

Pimelodus cyclopus, p. 117; 251-255; 363.

Wiedersheim, R. Ueber die mechanische Aufnahme der Nahrungsmittel in der Darmschleimhaut. Freiburger Festschr. 56. Vrs. Deutsch-Naturf. Ges., Freiburg & Tübingen, 1883, 8, supplement, 49-66.

Add. 1883.1

Wiegmann, F. A. Bericht über die Fortschritte der Zoologie im Jahre 1834. Arch. Naturgesch., 1835, 2, 268.

Add. 1835.1

Redescription of Meyen's *Pygidium fuscum*.

Wierzejski, Anton. Ueber Myxosporidien des Karpfens. [Text in Polish] Bull. Internat. Acad. Sci. Cracovii, 1898, 129-145. Abstract in Zool. Centralb., Leipzig, 1899, 6, 270-272.

Add. 1898.1

See also, Wierzejski, A., 1898.1 for a preliminary notice.

Wiese, J. Ueber russische Fische-reien. Deutsch. Fischerei Zeitg., 1913, 36. Jahrg., 499-500; 516-517; 530-532; 544-545.

Add. 1913.1

Wiet, —. L'élevage des salmonides à la ville. La pisciculture Pratique, 1899, 5, no, 11, 200.

Add. 1899.1

Wijhe, J. W. van. Die Kopfregion der Cranioten beim Amphioxus, nebst Bemerkungen über die Wirbeltheorie des Schädels. Anat. Anz., 1889, 4, 558-566.

Add. 1889.1

— Ueber Amphioxus. Anat. Anz., 1893, 8, 152-172.

Add. 1893.1

Wilcocks, J. C. Food of the rays. Zoologist, 1886. 3. ser. 10, 28-29.

Add. 1886.1

Wilcox, William A. Fisheries of the Pacific coast. Report U. S. Fish Comm. 1893 (1895), 19, 139-304.

Add. 1895.1

Wilder, Burt Green. What is the morphologic status of the olfactory portion of the brain? Science, 1898, n. s. 7, 150-152.

Add. 1898.1

— The educational uses of sharks and rays, especially the Acanth (*Squalus acanthias*, "Horned dogfish"). [Abstract] Proc. 12. Meet. N. Y. State Sci. Teachers Assoc., 1907. 2 p.

Add. 1907.1

— The taxonomic value of the brain. Science, 1911, n. s. 33, 389.

Add. 1911.1

Largely has reference to fishes.

Wilhelm, O., Henking, H., & Duge, F. See **Duge, Henking, & Wilhelm.**

Wilkes, Charles. Narrative of the United States exploring expedition during the years 1838-1840. Philadelphia, 1845. 5 vols. pls. & text-figs.

Add. 1845.1

Numerous notes and figures of methods of fishing. Porcupine skin helmets, vol. v, p. 48; noosing sharks, vol. v, p. 96.

Wilkinson, —. Ueber die Luftblasen der Fische. Verkundiger, 1804. 61. St., p. 485.

Add. 1804.1

Wilkinson, A. G. Salmon-fishing (in Mayer, A. M., Sport with gun and rod, etc., p. 401-448. New York, 1883)

Add. 1883.1

This is probably the full title for Anon. no. 284, iii.

Willem, V. Les origines de l'audition chez les vertébrés. Bull. Classe Sci. Acad. Roy. Belgique, 1913, 1231-1259.

Add. 1913.1

Willey, Arthur. Development of the atrial chamber of Amphioxus. Proc. Roy. Soc. London, 1890, 48, 80-89.

Add. 1890.1

— Contribution to the natural history of the pearly nautilus. I. Personal narrative (In his Zoological results based on material from New Britain, New Guinea, Loyalty islands and elsewhere. Collected 1895-97. Cambridge, 1902, pt. vi.)

Add. 1902.1

Fish traps, with figures, p. 699; *Amphisile strigata*, p. 718, with figure showing vertical swimming. *Asymmetron caudatum*, p. 724-725, with figure.

Willey, A.

— Inland fisheries (In Education, science, and art. Ceylon Administration Repts., Marine Biology, 1909, part IV, G9-G19). Add. 1909.1

Acclimatization of fishes; fishing methods; fish propagation; oral gestation in *Arius falcarius*.

Willey, A., Green, E. Ernest., & Reeves, E. Gordon. See **Reeves, E. Gordon, Willey, A., & Green, E. Ernest.**

Williams, Thomas. Organs of respiration [of fishes] (In Todd, R. B., Cyclopædia of anatomy and physiology. London, 1859, supp. vol. 5, 258-293. 35 figs.) Add. 1859.1

Williamson, Robert W. The Mafulu mountain people of British New Guinea. London, 1912. 364 p. 91 illust. Add. 1912.1

Fishing, communistic, with wier nets, p. 192-194; with spiders-web nets, p. 193.

— The ways of South sea savages; a record of travel and observation amongst the savages of the Solomon islands and primitive coast and mountain people of New Guinea. London, 1914. 12°. Add. 1914.1

Fishing with nets, weirs and spider-web nets, p. 230-231.

Williamson, (Captain) Thomas. The complete angler's vade mecum; being a perfect code of instruction on the above pleasing science, wherein are detailed a great variety of original practices and inventions. London, 1825. 18 pls. 12°. Add. 1825.1

Other editions: London, 1803 & 1808, xi, 316 p.; 1822.

Williamson, William D. The history of the state of Maine, from its first discovery, A. D. 1602, to the separation, A. D. 1820, inclusive. 2 vols. Hallowell, 1832. Add. 1832.1

Chapter on fishes, vol. I, 150-164.

Wills, James (translator). Natural history notes — a fishing fish — from a native manuscript. Antananarivo Annual, 1897, 6, no. xxi, pt. 1. Add. 1897.1

Fishing with the remora, p. 123.

Wilmot, —. [Address on identity of sea-trout and speckled trout] Trans. Amer. Fish-Cult. Assoc. 1876-77 (1877), 111-115. Add. 1877.1

Wilson, Charles Branch [1861-] North American parasitic copepods belonging to the family Caligidae.

Proc. U. S. Nat. Mus., 1905, 28; 1907, 31; 1908, 33. Add. 1905.1

i. Caliginæ, 28, 479-672. 25 pls. 50 text-figs.

ii. Trebinæ and Eurypherinæ, 31, 669-720. 6 pls. 19 text-figs.

iii & iv. A revision of the Pandarinæ and Cecropinæ. 33, 323-490. 26 pls. 18 text-figs.

— North American copepods; new genera and species of Caliginæ. Proc. U. S. Nat. Mus., 1908, 33, 593-627. 8 pls. Add. 1908.1

From fishes at Beaufort, N. C.

— Descriptions of new species of parasitic copepods in the collections of the United States National Museum. Proc. U. S. Nat. Mus., 1912, 42, 233-243. 5 pls. Add. 1912.1

— Crustacean parasites of West Indian fishes and land crabs, with descriptions of new genera and species. Proc. U. S. Nat. Mus., 1913, 44, 189-277. 36 pls. Add. 1913.1

Wilson, Edmund Beecher [1856-] On multiple and partial development in Amphioxus. Anat. Anz., 1892, 7, 732-740. Add. 1892.1

— Amphioxus and the mosaic theory of development. Journ. Morphol., 1893, 8, 579-638. Add. 1893.1

— The cell in development and inheritance. New York, 1900. 483 p. 194 figs. Add. 1900.1

Columbia University Biological Series. iv. This is the second edition, revised, enlarged, and many times reprinted. The first appeared in 1896.

Wilson, George. On the employment of the living electrical fishes as medical shock machines [Abstract] Edinburgh New Phil. Journ., 1857, 6, 330-331. Add. 1857.1

Wilson, (Capt.) James. A missionary voyage to the southern Pacific ocean, performed in the years 1796, 1797, 1798, in the ship "Duff," commanded by Capt. James Wilson, etc. London, 1799. Add. 1799.1

Fishing, 365-388; by seines, hooks, spears, weirs, floats, the mast, noosing sharks, diving, harpoons, etc. Poisoning by eating fish.

Wilson, J. P. A. Fish poisoning. Brit. Med. Journ., London, 1887, 2, 992. Add. 1887.1

Winterstein, Hans. (Editor) Handbuch der vergleichenden Physiologie. Jena, 1911. Add. 1911.1

This work, published in parts, was begun in 1911 and is not yet finished. It contains extensive bibliographies under each contributing author.

— Die physikalisch-chemischen Erscheinungen der Atmung (In Winterstein, Hans. Handbuch der vergleichenden Physiologie, Bd. I, Hälfte 2, p. 1-264. 68 figs. Jena, 1912.)

Add. 1912.1

Fische, p. 131-189. 17 figs.

Winther, M. Literaturæ scientiæ rerum naturalium in Dania, Norvegia & Holsatia usque ad annum MDCCCXXIX. Havniæ, 1829. 233 p.

Add. 1829.1

White, G. F., & Slyke, D. D. van. See **Slyke & White.**

Witry, Everlange de. Sur les glossopètres et les bufonites. Mém. Acad. Sci. Bruxelles, 1780, 2, pt. 3.

Add. 1780.1

Wollaston, A. F. R. Pygmies and Papuans; the stone age today in Dutch New Guinea. London, 1912. 352 p. illust.

Add. 1912.1

Fishing methods employed in southern New Guinea, p. 120-123.

Wolterstorff, W. Die Gattung Xiphophorus Heckel. Blätt. Aquar.-Terrar. Kunde, 1914, 25. Jahrg., 94-96. 2 figs.

Add. 1914.1

Wood, John George [1827-1899] Homes without hands, being a description of the habitations of animals, classed according to their principle of construction. London, 1867.

Add. 1867.1

Nest-building fishes.

— Bible animals; being a description of every living creature mentioned in the Scriptures from the ape to the coral. New . . . edition, London, 1876. xxix, 652 p. 24 pls. illust. 8°.

Add. 1876.1

Other editions, 1868 & 1869.

Wood, R. W. Fish-eye views and visions under water. Phil. Mag. & Journ. Sci., 1906, 6. ser. 12, 159-162. pl.

Add. 1906.1

See also Wood, R. W., 1906.1.

Woodcock, H. M. Note on a remarkable parasite of plaice and flounders. Proc. Trans. Liverpool Biol. Soc., 1903-04 (1904), 18, 143-152. 7 figs. Abstract in Bull. Institut. Pasteur, 1904, 2, 426. — Jahresb. Fortschr. Lehre Path. Microorg., Leipzig, 1906, 20, 168.

Add. 1904.1

See also Woodcock, H. M., 1903.1.

— On myxosporidia in flat fish. Proc. Trans. Liverpool Biol. Soc., 1903-04 (1904), 18, 126-142. pl. Abstracts in Bull. Institut. Pasteur, Paris, 1904, 2, 427. — Journ. Roy. Micros. Soc., London, 1904, 661. — Jahresb. Fortschr. Lehre Path. Microorg., Leipzig, 1906, 20, 164-165.

Add. 1904.2

See also Woodcock, H. M., 1903.2.

— Note on the identification of the (microsporidian) parasite. Proc. Trans. Liverpool Biol. Soc., 1906-07 (1907), 21, 307-308. 3 figs. Abstract in Bull. Institut. Pasteur, Paris, 1907, 5, 439.

Add. 1907.1

See also Woodcock, H. M., 1906.1.

Woodford, C. M. A naturalist among the head-hunters, being an account of three visits to the Solomon islands in the years 1886, 1887, and 1888. London, 1890. 249 p. illust.

Add. 1890.1

Habits of sharks, p. 35 & 37; of Periophthalmus, p. 96. Fishing with square dip-net, p. 163, with pearl shell hooks, p. 165.

Woodley, G. On the present state of the Scilly islands, their vast importance to the British empire, with a particular account of their fisheries. London, 1822. map. 8°.

Add. 1822.1

Woodroffe, Joseph F. The upper reaches of the Amazon. London, 1914.

Add. 1914.1

Native names of fishes, p. 39, 69, 97, 256-259. Habits of piranha, p. 95, 118. Penetration of urethra by Candiru, p. 95-96. Fishing methods, p. 129-131, 158.

Woodward, Arthur Smith [1864-] On the fossil teleostean genus Rhacolepis Agass. Proc. Zool. Soc. London, 1887, 535-542. 2 pls.

Add. 1887.1

— Note on an abnormal specimen of the dentition of Rhinoptera. Ann. Mag. Nat. Hist., 1888, 281-283. fig.

Add. 1888.1

— On the cretaceous selachian genus Synedochus. Geol. Mag., 1888, 3. dec. 5, 496-499. fig.

Add. 1888.2

— Note on a species of Pholidophorus (*P. nitidus*) from the Rhætic paper shales of Wigston. Trans. Leic. Liter. Phil. Soc., 1889, n. s., pt. XI, 22-23.

Add. 1889.1

— On the occurrence of the Devonian ganoid Onychodus in Spitzbergen. Geol. Mag., 1889, 3. ser. 6, 499-500.

Woodward, A. S.

Abstract in Rept. Brit. Assoc., 1889, 584. Add. 1889.2

— [Review of] *Fauna der Gaskohle und der Kalksteine der Permianformation Böhmens*, Bd. ii, Heft 3, by Anton Fritsch. *Nature*, 1889, **39**, 196–197. Add. 1889.3

— Description of a fish-skull (In Lydekker, R. Note on certain vertebrate remains from the Nagpur district. *Records Geol. Surv. India*, 1890, **23**, 20–24.) Add. 1890.1

Describes *Belonostomus* (?) *indicus* n. sp. from Lameta beds at Dongargaon.

— Fossil fish: translated and revised by A. S. Woodward. (In Zittel, K. A. von, *Text-book of palæontology* . . . English edition, &c. London & New York, 1902, vol. II.) Add. 1902.1

— Fossil fish remains from Natal. Pt. I. Notes on Cretaceous fish teeth from the mouth of the Umpenyati river, Natal. pp. 99–100. Pt. II, Note on some fossil fish scales from the coal measures of Somkele, Zululand. 3. *Rept. Geol. Surv. Natal & Zululand*, 1907, 99–101. pl. Add. 1907.1

— On some remains of *Pachycormus* and *Hypsocormus* from the Jurassic of Normandy. *Mem. Soc. Linn. Normandie*, 1908, **23**, 29–34. pl. Add. 1908.1

— The fossil fishes of the English Wealden and Purbeck formations. Part II. *Monogr. Palæontogr. Soc.*, 1918, **70**, 49–104. 10 pls. *Ibid.*, 1919, **71**, 105–148. 6 pls. Add. 1918.1

For Part I, see Woodward, A. S., 1916.1.

Worth, S. G. Fish culture in North Carolina (In Polk, L. L. Report of the North Carolina commissioner of agriculture, 1877–78. Pub. Doc. no. 8, session General Assembly, 1879). Raleigh, 1879. 26 p. Add. 1879.1

— Report of superintendent of fish and fisheries for the years of 1879–1880 (In Report of the board of agriculture to the General Assembly of North Carolina, 1879–1880, p. 25–51). Raleigh, 1881. Add. 1881.1

— Fish culture in North Carolina. *Monthly Bull. N. C. Bd. Agric.* August 1883, 3–8. Add. 1883.1

— Second biennial report of superintendent of fish and fisheries of North

Carolina (for 1881–82) (In Report of the board of agriculture, document no. 18, session of the North Carolina Legislature. 1883, p. 62–81) Raleigh, 1883. Add. 1883.2

— The fishing industry of North Carolina. *Monthly Bull. N. C. Dept. Agric.*, March, 1884, 8–9. Add. 1884.1
Single seine haul of 400,000 alewives.

— Report upon the propagation of striped bass at Weldon, N. C., in the spring of 1884, *Bull. U. S. Fish Comm.*, 1884, **4**, 225–231. pl. Add. 1884.2

— Third biennial report of the superintendent of fish and fisheries, of the state of North Carolina, for the years 1883–84, p. 35. Raleigh, 1885. Add. 1885.1

— Report on the propagation and distribution of food-fishes. *Rept. U. S. Fish Comm.* 1893 (1895), **19**, 78–138. Add. 1895.1

— Striped bass hatching in North Carolina. *Trans. Amer. Fisheries Soc.*, 1903, 98–102. Add. 1903.1

— Fresh-water shrimp, a natural fish food. *Proc. 4. Internat. Fishery Congr.*, Washington, 1908. *Bull. U. S. Bur. Fisheries*, 1908 (1910), **28**, pt. 2, 853–858. Add. 1910.1

— Observations concerning the natural food of small-mouth black bass fry at Mammoth Spring, Ark. *Trans. Amer. Fisheries Soc.* 1910 (1911), 145–148. Add. 1911.1

Wright, C. R. Alder, & Mitchell, C. A. Animal and vegetable fixed oils, fats, butters and waxes. Their preparations and properties. 2d edition. London, 1903. Add. 1903.1

Numerous references to fish oils and their uses.

Wright, E. Perceval [1834–1910] Six months at the Seychelles. *Spicilegia Zoologica*, Dublin, 1870, pt. 1. Add. 1870.1

Notes on *Rhineodon typus*, p. 64–65.

— On a new genus and species of the family Pandarina. *Proc. Roy. Irish Acad.*, 1874–77 (1877). 583–584. Add. 1877.1

Contains notes on *Rhineodon typus*, the host of the parasite.

— Animal life: being a series of descriptions of the various sub-king-

doms of the animal world. London, [1879] illust. roy. 8°. Add. 1879.1

Has a section on fishes, p. 415-468, describing, among others, *Rhineodon typus*.

Wright, E. Perceval (translator) See **Figuier, L.**, Add. 1891.1.

Wright, Harrison. Report of a committee of the Wyoming Historical and Geological Society on the early shad fisheries of the north branch of the Susquehanna river. Bull. U. S. Fish Comm. 1881 (1882), 1, 352-379. Add. 1882.1

Wright, Robert Ramsay. Preliminary report on the fish and fisheries of Ontario. Rept. Ontario Game & Fish Comm., 1892, 422-476. Add. 1892.1

Wright, Sidney. The romance of the world's fisheries. Interesting descriptions of the many and curious methods of fishing in all parts of the world. London, 1908. 320 p. illust. Add. 1908.1

Wright, Thomas. Popular treatises on science written during the Middle Ages. London, 1841. 140 p. 8°. Add. 1841.1

Würtz, Geo. Ceph. (respond.) Dissertatio: Affinitatum animalium tabula brevi commentario illustrata. Argentorati, 1777. 15 p. pl. 4°. Add. 1777.1

Joh. Hermann, *præses*.

Another edition, Argentorati, 1783.

Wulff, Joh. Christ. Ichthyologia cum amphibius regni Borussici methodo

Linnæana disposita. Abstract in Comment. Lips., 15, 96. — Jen. Gel. Zeit., 1766. — Erl. Gel. Beytr., 1766, 534. — Götting. Gel. Anz., 1766, 648.

Add. 1766.1

Abstracts of Wulff, Joh. Christ., 1765.1.

Wutte, M. Alte Fischereiordnungen in Kärnten. Oesterr. Fischerei-Zeitg., 1912, 9, 131-134. Add. 1912.1

Wyman, Jeffries [1814-1874] [Ascarides from *Cyclopterus lumpus*] Proc. Boston Soc. Nat. Hist., 1841-44 (1844), 1, 103. Add. 1844.1

— [Echinorhynchus nodosus in the striped bass] Proc. Boston Soc. Nat. Hist., 1841-44 (1844), 1, 95-96.

Add. 1844.2

— [On the eggs of the skate] Proc. Boston Soc. Nat. Hist., 1851-54 (1854), p. 165. Add. 1854.1

— [Remarks on a bagre whose breeding habits had just been described by Mr. John Green] Proc. Boston Soc. Nat. Hist., 1858, 6, 328. Add. 1858.1

Oral gestation in a catfish from Surinam.

— On the mode of impregnation of the ova in Pomotis. Proc. Boston Soc. Nat. Hist., 1862-63 (1863), 9, 253. Add. 1863.1

— On the occurrence of eels in the abdominal cavity of the cod. Proc. Boston Soc. Nat. Hist., 1866-68 (1868), 11, 364. Add. 1868.1

Y

Yamawaki, Gi. On poisoning by the fugu fish (*Tetrodon*) [Text in Japanese] Iji Shinbun, Tokio, 1883 (May 5). Add. 1883.1

Yarrell, William [1784–1856] On the preservation of whitebait (*Clupea alba* Yarr.) alive. Proc. Zool. Soc. London, 1830–31 (1831), 13. Add. 1831.1

— On the occurrence of the anchovy in the Thames. Proc. Zool. Soc. London, 1838, 66. Add. 1838.1

Yoshinaga, Torama, & Tanaka, Shigeho. See **Tanaka & Yoshinaga.**

Young, I. C. The shore fisheries of Massachusetts. Rept. Comm. Inland Fisheries & Game, Massachusetts, 1894 (1895), 33–34. Add. 1895.1

Young, Thomas. Narrative of a residence on the Mosquito Shore. London, 1847. 172 p. Add. 1847.1

Many incidental notes of but little value on fish and fishing. List of fishes — local names — p. 21–22.

Younger, John. River angling for salmon and trout, with a memoir of the author: together with a treatise on

the salmon, and a list of the Tweed salmon-casts. Kelso & Edinburgh, 1864. xii, 220 p. 16°. Add. 1864.1

Other editions are: Edinburgh, 1840; Kelso & Edinburgh, 1860.

Yung, E. J. J. Recherches sur la digestion des poissons (Histologie et physiologie de l'intestine) Arch. Zool. Expér., 1899, 3. ser. 7, 121–201. pl. Add. 1899.1

Extensive bibliography.

— Deux cas tératologiques. Arch. Sci. Phys. Nat. Genève, 1914, (4), 37, 76–77. Add. 1914.1

Nageoire supplémentaire chez *Tinca vulgaris*.

— La station de zoologie lacustre de l'Université de Genève et les variations quantitatives du plankton dans le Léman. 9. Congrès Internat. Zool., Monaco, 1913 (1914), 98–112. 5 figs. Add. 1914.2

i. Technique de la capture du plankton. p. 100–105.

ii. Dosage du plankton. p. 105–107.

iii. Recensement des diverses espèces pélagiques. p. 107–108.

iv. Pêches en étage. p. 108.

v. Résultats généraux relatifs à la distribution du plankton et ses variations quantitatives. p. 108–109.

Z

Zacharias, Otto. Skizze eines Spezialprogrammes für fischereiwissenschaftliche Forschungen. Fischerei Zeitg., 1904, 7, no. 39. 4 p. — Zeitschr. Allgem. Physiol., 1905, 5, Referate, 10. Add. 1904.1

Zahn, Gustav. Flora, amphibia, reptiles and fish of the Seeberg. (In Naturwissenschaftliches und Geschichtliches vom Seeberg. Naturwissensch. Ver. Gotha, 1901. 8°.) Add. 1901.1

Zampieri, C. Produzione naturali che si ritrovano nel Museo Ginanni in Ravenna. Lucca, 1762. Add. 1762.1
Bolca fishes studied & classified.

Zavattari, Edoardo. Muscoli ioidei dei sauri (In Rapporto con i muscoli ioidei degli altri vertebrati. Part II) Mem. R. Accad. Sci. Torino, 1910, 2. ser. 61, 53-134. pl. Add. 1910.1
Pesci, p. 55-60.

Zietz, Amandus H. C. Description of a hitherto undescribed species of shark [*Scyllium vincenti*] from Investigator strait. Trans. Roy. Soc. South Australia, 1908, 32, 287. Add. 1908.1

— A synopsis of the fishes of South Australia. Trans. Roy. Soc. South Australia, 1908-1909, 32 & 33. Add. 1908.2

- i. Leptocardii, Cyclostomata, Plagiostomi, and Holocephali. 1908, 32, 288-293.
- ii. Clupeidæ to Syngnathidæ. *ibid.*, 294-299.
- iii. Syngnathidæ contd. to Serranidæ, 1909, 33, 263-269.

Zschokke, Fritz [1860-] Ueber Bothriocephalenlarven in *Trutta salar*. Centralb. Bakter. Parasitenk., 1890, 7, 393-396; 435-439. 5 figs. Add. 1890.1

— Die Parasitenfauna von *Trutta salar*. Centralb. Bakter. Parasitenk., 1891, 10, 694-699; 738-745; 792-801; 829-838. 8 tables. Add. 1891.1
Complete reference for Zschokke, F., 1889.1

— Zur Faunistik der parasitischen Würmer von Süßwasserfischen. Centralb. Bakter. Parasitenk., 1896, 19, 772-784; 815-825. Add. 1896.1

— *Myxobolus bicaudatus* n. sp., ein Parasit der Coregoniden des Vierwaldstätter Sees. Mitth. Naturf. Ges. Luzern, 1898, 2. Hft., 205-217. pl. Add. 1898.1

— Die Myxosporidien in der Muskulatur der Gattung *Coregonus*. Zool. Anz., 1898, 21, 213-214. Add. 1898.2

Zschokke, F., & Reitz, A. Entoparasiten aus Salmoniden von Kamtschatka. Rev. Suisse Zool., 1914, 22, 195-256. pl. Add. 1914.1

Zuchold, E. v., Guthe, H., & Metzger, A. (editors). Bibliotheca historico-naturalis, physicochemica et mathematica. Göttingen, 1866-1881. Add. 1866.1

III

TITLES OF PRE-LINNÆAN PUBLICATIONS¹

A

Abbeville, Claude d' [—1632] *Histoire de la mission des Pères Capucins en l'isle de Maragnan.* Paris, 1612. Pre-Linn. 1612.1

Various fishes described, which are referred to by De Laet in his "Novus Orbis," 1633, p. 616, and in the French edition of the same, 1640, p. 554.

In the 2nd ed., Paris, 1614, on p. 245, is found the earliest description of the spotted eagle ray, *Aetobatus narinari*.

Abbondio, Giovanni. *Delle constructione della peschiere chiuse e de vivia; con un trattato della pesca di Giulio Navarino, ad uso della genti di Campagna.* Palermo, 1715. 4°. Pre-Linn. 1715.1

Acosta, José d' [1539–1600] For life and explorations of this early Spanish traveller, see Miall, L. C., 1912.1. (pp. 64–71); J. R. Carricido, "El Padre José de Acosta," etc. Madrid, 1899; C. Sommervogel, "Bibliothèque de la Compagnie de Jésus," pt. 1, vol. I, cols. 31–42, Brussels & Paris, 1890; and E. Grimston as cited below.

— *De natura Novi Orbis libri duo, et de promulgatione evangelii, apud barbaros, sive de procuranda Indorum salute libri sex.* Autore Josepho Acosta presbytero societatis Jsu. Salamanticæ [Salamanca], 1589. 640 p. 8 pl. 8°. Pre-Linn. 1598.1

This is the *editio princeps*. The book appeared in many editions and translations too numerous to list. Records are at hand of 4 eds. at Seville, 1589–91; 2 at Madrid, 1608–10; 3 at Salamanca, 1589–1595; Barcelona, 1591–94; Paris, 4, 1597–1616; Venice, 1596; Amsterdam, 1624; Cologne, 1598; Ursel, 1605, and Francofurt, 1617.

Early editions in other languages are:

— *Historia natural y moral de las Indias, en que se tratan las cosas notables del cielo, y elementos, metales, plantas y animales, etc.* Sevilla, 1590. 535 p. 4°. Pre-Linn. 1590.1

De diversos pescados y modos de pescar de las Indias, lib. III, cap. 17 [i. e. 15] p. 158–162. Flying fishes are also described.

— *Historia naturale e morale delle Indie, etc.* Venetia, 1596. 173 p. 4°. Pre-Linn. 1596.1

— *Histoire naturelle et morale des Indes, tant Orientales qu'Occidentales.* Paris, 1598. 375 p. 8°. Pre-Linn. 1598.1

— *Historie naturael ende morael, van de Westersche Indien, etc.* Haerlem, 1598. xii, 389 p. 8°. Pre-Linn. 1598.2

— *De novi orbis natura et ratione* (In De Bry, *Grands Voyages — America*, pt. IX, [Text in Latin]. Francofurt, 1602. 362 p.) Pre-Linn. 1602.1

— *Naturall and morall historie of the East and West Indies, etc.* Translated by E. G. [Grimston], London, 1604. Pre-Linn. 1604.1

Of fishers and the manner of fishing in the Indies, book III, chap. xv, pp. 163–169.

The most available English version is the Hakluyt Society reprint in *Works*, nos. 60 & 61, bearing the title: "The natural and moral history of the Indies," etc. London, 1880.

Acuña, Christoval de [1597—c.1655] *Nuevo descubrimiento del gran Rio de los Amazonas, i viague de la provincia del Quito en el reyno del Peru.* Madrid 1641. 4°. Pre-Linn. 1641.1

Translations into French, English and German are:

— *Rélation de la rivière des Amazones, traduite de l'Espagnole par M. Gomberville.* 2 vols. Paris, 1682. 12°. Pre-Linn. 1682.1

— *Voyage and discoveries up the river Amazon to Quito in Peru and back again to Brazil, etc.* (In Acuña, C. d', Acarete, —, Grillet, J., & Bechamel, F. *Voyages and discoveries in South America.* 3 parts. London, 1698, pt. I, viii, 190 p.) Pre-Linn. 1698.1

Part I, chap. xxv is entitled: "The great plenty of fish in this river [Amazon] and which is the best sort of them."

¹ Literature of fishes *ante* 1758, the date of the 10th edition of the *Systema Naturæ*.

— Reise . . . auf dem Amazon-flusse, (1639–40) (In Arkstee, —, & Merkus, —, Allgemeine Historie der Reisen, etc., 1758, vol. XVI. 4°.)
Pre-Linn. 1758.1

Acuña's work is available for English readers in the Hakluyt Society reprint, in Works, no. 24 for 1859: "A new discovery of the great river of the Amazons, 1639, etc." In this see — Methods of fishing used by the Indians, description of the paraque or electric eel, etc.

Adanson, Michel [1727–1806] *Histoire naturelle du Sénégal. Coquillages. Avec une relation abrégée d'un voyage fait en ce pays, pendant les années 1749–1753.* Paris, 1757, viii, 190; xcvi, 275 p. 19 pls. map. 4°.
Pre-Linn. 1749.1

Contains a reference to the electric catfish, *Malopterurus* (p. 134).

Translated into English as:

Voyage to Senegal, the Isle of Goree, and the river Gambia. London, 1759. 8°.

There are German translations by Martinus, Brandenburg, 1773, and by Schreber at Halle in the same year.

Ad-Damiri, Imâm Kamâl-ad-dîn [1341 or 49–1405] *Hayât al-Hayawân.* [MS. c. 1372] Pre-Linn. 1372.1

This Arabic natural history lexicon was composed by the author while professor in the University of Al-Azhar at Cairo. It was first printed in Arabic at Cairo, 1858; reprinted Cairo, 1867, 1887, & in 3 other issues before 1903. An illustrated edition (in Persian?) has been issued at Teheran, and a version, presumably in Turkish, at Constantinople. It is most available as:

Ad-Damiri's *Hayât al-Hayawân.* (A zoological lexicon.) Translated from the Arabic by A. S. G. Jayakar. 2 vols. London & Bombay, 1906–08.

2nd vol. in 2 parts. Each vol. and part paged separately.

For reference to fishes, see indices.

Ælfric (*Archbishop of Canterbury*) [955—c.1020] *Colloquium [Latine et Saxonice] . . . ab Ælfrico primum compilatum, etc.* [MS. c. 990].
Pre-Linn. 990.1

The oldest English treatise on fishing is contained in this work.

The original, a MS. of the 10th century, is in the Cottonian collection of the British Museum. Reproduced in Thorpe, B., "Analecta anglo-saxonica," 1834, p. 101–118, and 1846, pp. 18–36. See also Wright, Thomas, "A volume of vocabularies," etc., 1857.

For an English translation, with many valuable notes on the names of the fishes mentioned, see Prof. W. W. Skeat in the "Angler's note-book," 1880, pp. 76–77; 155–156; 168–170.

Ælian, Claudius [fl. c. 120 A. D.] *Ex Æliani historia per Petrum Gyllium latini facti, itemque ex Porphyrio, Heliodoro, Oppiano, tum eodem, Gyllio luculentis accessionibus aucti libri xvi,*

de vi et natura animalium. Ejusdem Gyllii liber unus, de Gallicis et Latinis nominibus piscium. Lugduni, 1533. 28, 589 p. 4°.

Pre-Linn. 1533.1

Pisces, lib. xi–xiii.

An exceedingly rare and very beautiful edition of this famous work. Other pre-Linnæan editions are: Rome, 1535 or 1545; Zurich, 1555 or 1556; Lyons, 1535 & 1562; Lugduni, 1611; Geneva & Cologne (Gesner & Gilles eds.), 1616; Basel, 1750; London, 1744—given below.

— *De natura animalium, libri xvii. Cum animadversionibus C. Gesneri et D. W. Trilleri. Curante Abr. Gronovio* [Text in Greek and Latin] Londini, 1744. 4°.
Pre-Linn. 1744.1

Of modern editions the best are:

Æliani *de natura animalium libri xvii. Græca et Latine cum priorum interpretum et suis animadversionibus* edidit J. G. Schneider. 2 vols. [in 1] Lipsiæ, 1784.

Æliani *de natura animalium libri septemdecim. Verba ad fidem librorum manuscriptorum constituit et annotationibus illustravit F. Jacobs. Intextæ sunt curæ secundæ postumæ J. G. Schneideri . . . Adjecti indices et interpretatio Latina Gesneri a Gronovio emendata* (. . . Cum addendis et conjuncturis ineditis J. J. Reiskii). 2 vols. Jena, 1832. 8°.

Vol. I contains the Greek text, followed by the Latin translation, which has a distinct pagination; vol. II contains the notes.

There is also a later edition published at Paris by Didot in 1858.

Ælian is the first, and indeed the only writer among the ancients who mentions the use of the artificial fly in fishing for trout. See book xv of his history.

Agrippa, Heinrich Cornelius [1486–1535] *Henric Cornelius Agrippa, of the vanitie and uncertaintie of artes and sciences.* Englished by Ja. Sam. Gent., etc. London, 1569. 4°.
Pre-Linn. 1569.1

Chapter LXXVI of this caustic satire on the kinds of learning in vogue in Agrippa's age is "Of fishing": "The study of fishing was in time past emonge the Romaines in so greates price, and estimation that they did sow in the Italian sea, as it were corne in the ground. . . . Furthermore with great costs they made great fishe pooles and pondes full of most pretious fishes, etc."

Aitzema, Lieuwe van [1600–1669] *Saken van Staet en Oorlogh, in, ende omtrent de Vereenigde Nederlanden* (1621–1669). 's Gravenhage [The Hague], 1669. 6 parts. fol.
Pre-Linn. 1669.1

Contains considerable data about herring fisheries.

Albertinus, Ægidius. *Der Welt Tummel: und Schauplatz, sampt der bitter-süssen Warheit. Darinn mit Einführung viler schöner und fürtrefflicher Discursen nit allein die natürliche, sondern auch moralische und sittliche*

Albertinus, A.

Eigenschaften und Geheimnissen der fürnembsten Creaturen und Geschöpf sehr lustig, geist- und politischer Weiss erklärt. München, 1613, xii, 1048 p. 4°.

Pre-Linn. 1613.1

Pt. v, Fishes.

Albertus Magnus [1193 or 1205–1280] For articles on his life and works, see Sighart, J. 1857.1; Stadler, H. 1903.1, 1909.1, Add. 1907.1, 1912.1, 1912.2, 1913.1; also Saintyves, P. in "Revue des traditions populaires." Paris, 1913, 556–564.

For a list of the authorities cited by Albertus in his "De Animalibus," see Buhle in Kön. Gesell. Wiss. Göttingen, Commentationes, 12.

— De animalibus. Libri xxvi. Rome, 1478. fol. Pre-Linn. 1478.1

This is the *editio princeps*. Almost equally rare is the 2nd edition, the Mantua folio of 1479. Other old eds. are: Venice, 1490, 1495, 1498, 1519; Cologne, 1541 & 1546; Frankfort, 1546. An early German translation is entitled:

— Thierbuch von Art, Natur und Eigenschaft der Thiere nemlich von Vierfüßigen, Vögeln, Fyschen, Schlangen und Insecten durch Waltherum Ryff verteutschet. Frankfurt-an-Main, 1546. fol.

Pre-Linn. 1546.1

— Opera omnia, edita studio et labore P. Petri Jammy. XXI vols. Lugduni, 1651. fol.

Pre-Linn. 1651.1

The most famous edition of Albertus' collected works. Copy, N. Y. P.

Fishes are treated in vol. VI, book xxiv, the title of which reads as follows:

— De animalibus lib. xxvi. Lugduni, 1651. 684 p. fol.

Pre-Linn. 1651.2

For a modern edition of the works of Albertus, consult: "Opera omnia cura Aug. Borgnet edidit. Historia animalium libri xxvi." Parisiis, 1891.

"Albert's work is not such an inorganic compilation as Thomas's. He has paraphrased the ten books of Aristotle's natural histories, his four books on the parts of animals, and his five books on their generation. To these nineteen, he has added seven books on the nature of animal bodies and on their grades of perfection; and then on quadrupeds, birds, aquatic animals, snakes and small bloodless creatures. Besides Aristotle, he draws on Avicenna, Galen, Ambrose (!) and others, including Thomas of Cantimpré. Thus, his work is made up mainly of the ancient written material. Moreover, Albert is kept from a natural view of his subject through the need he feels to measure animals by the standards of human capacity, and learn to know them through knowing man." Henry Osborn Taylor, "The Mediæval Mind," vol. II, p. 429, London, 1911.

Albin, Eleazer [1713–1759] The history of esculent fish. London, 1724. 4°.

Pre-Linn. 1724.1

To this edition was appended Roger North's "A discourse of fish and fish-ponds" first published 1713.

For another edition, 1794, see Albin, E., 1794.1. Copy, A. M. N. H.

— Icones piscium, cum nominibus latinis, anglicis et gallicis; cum figuris æneis. London, 1735–41. 4°.

Pre-Linn. 1735.1

Albrecht, Johann Sebastian [1695–1774] Phoenix Germanus, oder Bilderpostill, darim über ein jedes Evangelium ein besonderes Thier vom Vögeln, Fischen, &c. vorgestellt wird. Francfort, 1670. 4°.

Pre-Linn. 1670.1

Alciati, Andrea [1492–1550] For a biography and an estimate of Alciati's book, see Green, Henry, "Andrea Alciati and his book of emblems: a biographical and bibliographical study." London, 1872.

— Emblemata. Augsburg, 1531.

Pre-Linn. 1531.1

Often reprinted — at least 174 eds., 1531–1749. In 1871, the Holbein Society published at Manchester a photolithograph facsimile reprint of the Lyons 1551 edition. The full title seems to be that for the 1581 edition.

— Omnia emblemata: cum commentariis, quibus emblematum omnium aperta origine, mens auctoris explicatur, & obscura omnia dubiaque illustrantur; per Claudium minoem divionensem. 3rd ed. Antverpiæ, 1581.

Pre-Linn. 1581.1

Remora as a ship-stopper, p. 101; 303–304.

Aldrovandi, Ulisse [1522–1605 or 07] For memoirs, see Andres, A. 1908.1; Fantuzzi, G. "Memorie della vita di Ulisse Aldrovandi con alcune lettere scelte d'uomini eruditi a lui scritte, e coll' indice delle sue opere MSS. che si conservano nella biblioteca dell' istituto." Bologna, 1774. portr. 8°; and Macgillivray, W. in Jardine's Naturalist's Library, 1845–46, Mammalia, vol. III.

— De piscibus libri v, et de cetis liber unus. Bononiæ, 1613. iv, 732 (26) p. illust. fol. Pre-Linn. 1613.1

1st ed. Others are: Venice, 1614, 1616; Frankfort, 1623, 1629, 1640; Bologna, 1625, 1638 (2 eds.), 1642, 1644.

— Monstrorum historia, cum paralipomenis historiæ omnium animalium.

Bartholomæus Ambrosinus labore et studio volumen composuit. Bononiæ, 1642. Pre-Linn. 1642.1

Monstrosus cyprinus, p. 352. Monstrosus sus marinus, p. 353. Piscis biceps, p. 428. Paralipomena historiæ, Piscium & Ceterorum, pp. 54-98.

— **Musæum metallicum in libros III. distributum.** B. Ambrosinus . . . composuit . . . M. A. Bernia . . . in lucem edidit, &c. Bononiæ, 1648. iv, 979, 13 p. illust. fol.

Pre-Linn. 1648.1

Fossil fishes, p. 102-104. 453-454, 764. Ray spine, p. 490. De glossopetra (sharks' teeth), p. 600-606. De ceraunia (sharks' teeth), p. 606-612. Lapis auratæ piscis et tiburonis, pp. 796-798.

Another edition is:

— **Synopsis musæi metallici . . . edita à D. Kellnero.** Lipsiæ, 1701. 258 p. 12°. Pre-Linn. 1701.1

Aldrovandi, professor of philosophy and medicine at Bologna, spent his life and fortune in collecting materials for a gigantic natural history which was intended to cover the whole field as it had not been done even by Conrad Gesner. Five volumes had been published at the time of his death, and the other eight were published posthumously under the editorship of Joannes Cornelius Uterverius.

Alischer, Sebastian. De carpine hermaphroditico, oder von einer Karpfe, so Milch und Rogen gehabt. Natur u. Kunstgesch., Breslau, 1720, 14, 645.

Pre-Linn. 1720.1

Allamand (junior), Jean Nicola Sebastian [1713-1787] Kort verhaal van de uitwerkzelen, welke een Americaanse vis veroorzaakt op de geenen die hem aanraaken. Verhandl. Hollandsch. Maatsch. Wetensch. Haarlem, 1756, 2, 372-379. Pre-Linn. 1756.1

"Piscis ex Gymnoti genere in America Meridionali frequens, effectus tales prodit quos Torpedo in Italia."

Also found in Hannov. Samml., 1756, 2. Th., 27. St. — Hamb. Mag., 1756, 2, 178. Abstract in Comment. Lips., 1756, 8, 396.

Allen, Benjamin. Of the manner of the generation of eels. Phil. Trans. Roy. Soc., 1697 (1698), 19, no. 231.

Pre-Linn. 1698.1

Alpinus, Prosper [1553-1616 or 17. — **Travels in Egypt** (In Ray, John) A collection of curious travels and voyages, etc. 2 vols. (in 1) London, 1693, xxvii, 396, 186, 45 p. 8°.)

Pre-Linn. 1693.1

Alpinus's travels are found in vol. II. This "collection" was reprinted in 1738.

A separate publication is:

— **P. Alpini . . . Historiæ Ægypti naturalis pars prima (- secunda) . . . Opus postumum.** etc. Lugduni Bata-vorum (Leyden), 1735. 248, 306 p. 25 pls. 4°. Pre-Linn. 1735.1

Fishes, pp. 201-203.

Other editions: Venice, 1591; Lyons, 1619 (in French); Padua, 1639. Alpinus's travels are also included in vol. II of:

— (Ray, John. **Travels through the Low Countries, etc.** To which are added a collection of curious travels etc. . . . collected from the observations of . . . P. Alpinus . . . and others. 2nd. ed. 2 vols. London, 1738) Pre-Linn. 1738.1

Alpinus, professor and prefect of the University of Padua, was Venetian consul at Cairo, 1580-1584. The original edition of his "Travels" is not known.

Ambrose, (Saint) [c. 340-397] **Hexæmeron de principis rerum libri vi.** Augustæ Vindelicorum (Augsburg), 1472. fol. Pre-Linn. 1472.1

This is the much prized 1st ed. Copies; L. C., & H. E. H.

Another ed. is dated c. 1481. A later ed. is listed below.

— **Opera.** 3 vols. Basel, 1492. fol. Pre-Linn. 1492.1

Fishes, vol. I, book v.

Other eds.: Lugduni, 1559; Paris, 1686-90. 2 vols. fol.

— **Divi Ambrosii, Mediolanensis episcopi, Hexæmeron libri vi.** Basileæ, 1566. 88 p. fol. Pre-Linn. 1566.1

The names of a score of fishes are given in book v., but no descriptions are added.

Ambrosius, Divus (Bishop of Milan). See **Ambrose, Saint.**

Anderson or Andersen, Johann [1674-1743] **Nachrichten von Island, Grönland und der Strasse Davis, zum wahren Nutzen der Wissenschaften und der Handlung.** Nebst einem Vorbericht von den Lebensumständen des Herrn Verfassers. Hamburg, 1746. xxx, 333 p. 5 pls. map. 8°.

Pre-Linn. 1746.1

This work, which contains considerable data about fishes, passed through many editions: Frankfort and Leipsic, 1747; Copenhagen, 1748; Paris, 1750, 1754, 1764; Amsterdam, 1750, 1756; London, 1758. fol.

Danish & Dutch versions are:

— **Efterretninger om Island, Grönland og strat Davis, med en tilgift som videre efterretning om Island.** Kjöbenhavn, 1748. 356 p. pls. 8°.

Pre-Linn. 1748.1

— **Beschryving van Ysland, Groenland en de Straat Davis . . . Benevens**

Anderson, J.

een voorbericht, bevattende levensbyzonderheden van den Schryver. Uit het hoogduitsch verstaalt. Amsterdam, 1750, xvi, 286 p. 6 pls. 4°.

Pre-Linn. 1751.1

See also note under Horrebow, N., Pre-Linn. 1758.1

Andrew, Laurence. The wonderful shape and nature of man, beastes, serpentes, fowles, fishes, and monsters, translated out of divers authors, by Laur. Andrew, of Calis. Antwerp, 1510. ills. fol. (*black letter*)

Pre-Linn. 1510.1

Anglicus, Bartholomew. See **Bartholomæus Anglicus.**

Ankarkrona, Theodore [1687–1750] Beschreibung des Fünffingerfisches. Abhand. Schwed. Akad., 1740, 2, 242–245. pls.

Pre-Linn. 1740.1

See note under Kästner, A. G., in this section.

— Beskrifning ofver famfingers fisken. Svensk. Vetensk. Akad. Handl., Stockholm, 1740, 2, 457.

Pre-Linn. 1740.2

Describes *Coryphæna pentadactylus* Bloch.

Antonius, G. (*præses*) Disputatio juridica de jure venandi, aucupandi et piscandi. Inaug. Dissert. Marpurgæ, 1604. 3 pls. 4°.

Pre-Linn. 1604.1

Jacobus Ninmero, *respond.*

Aquinas, (Saint) Thomas (*surnamed Doctor Angelicus*) [c. 1225–1274] For a brief account of the life and works of this learned man, and for a list of biographies and editions of his books, see Martin, T. L., & Mitchell, J. M. in *Encyclopædia Britannica*, 11th ed., 1910, vol. II, p. 250–252.

— *Summæ theologicæ. Partes III.* Basel, 1485.

Pre-Linn. 1485.1

Clupeoid fishes named *Sarda* and *Harenga* are mentioned in connection with canonizing ceremonies. The first of these names occurs also in *Isidore* and seems to refer to the sardine.

An early ed. of the complete work. Issued in 3 parts separately and in fractions of these parts as well as a whole from 1467 ("Partes secundæ; secunda pars," Mainz) on, this work passed through a great number of editions and translations. Of 15th century issues alone there are, of the whole work, or of its parts, in America alone, 32 eds. For these, see "Census of 15th Century Books in America."

The best modern eds. of the "*Summæ Theologicæ*" are that of Rome, 1882–1903 (prepared at the expense of Leo XIII); and one in English by J. M. Ashby. London, 1888.

Arctædius, Petrus. See **Artedi, P.**

Arctander, Sever. (*respond.*) *Piscis ille grandissimus, qui Jonam integrum devoravit.* Hafniæ, 1698. 4°.

Pre-Linn. 1698.1

Johannes Beenius, *præses.*

Arderon, William [1703–1767] A letter concerning the perpendicular ascent of eels. *Phil. Trans. Roy. Soc.* 1747 (1748), 44, 395–396.

Pre-Linn. 1748.1

— A letter containing some observations made on the bansticle, or pricklebag, alias prickle back, and also on fish in general. *Phil. Trans. Roy. Soc.*, 1747 (1748), 44, 424–428.

Pre-Linn. 1748.2

— A letter on keeping of small fish in glass jars, and of an easy method of catching fish. *Phil. Trans. Roy. Soc.*, 1746 (1748), 44, 23–27. — *Hamburg. Mag.*, [1748?], 2, 482.

Pre-Linn. 1748.3

The method of catching fish is one adopted at a small country town near Norwich, wherein worms, enclosing a thorn, are attached by threads, in hundreds, to the bushes overhanging a stream, for the purpose of catching the fish.

— A letter concerning the hearing of fish. *Phil. Trans. Roy. Soc.*, 1748 (1750), 45, 149–155. — *Hamburg. Mag.*, 1750, 5, 655–663.

Pre-Linn. 1750.1

— [Observations on keeping fish in glasses.] *Phil. Trans. Roy. Soc.*, 1748 (1750), 45, 321–323. fig.

Pre-Linn. 1750.2

First known reference to fungus parasitic on fish.

Argenville, Ant. Jos. Dezallier d' [1680–1765] *L'histoire naturelle . . . l'oryctologie, qui traite des terres, des pierres, . . . et autres fossiles, etc.* Paris, 1754. 560 p. pls. 4°.

Pre-Linn. 1754.1

American fishes engraved from Plumier's drawings, pl. 26, figures 1–4.

Fossil fishes figured, pl. 18; listed, pp. 334–341; 350–353.

Another ed., Paris, 1755. Copy 1754 ed., Col.

Argillander, Abraham. Rön om Gjädd-leken. K. Svensk. Vetensk. Acad. Handl., 1753, 15, 74–77.

Pre-Linn. 1753.1

— Untersuchung vom Laichen des Hechtes. König. Schwed. Akad. Abhandl., 1753, 15, 77–79. — *Hollands. Mag.*, 1753, 2, 569. Notice in *Comment. Lips.*, 1753, 5, 10.

Pre-Linn. 1753.2

See note under Kästner, A. G., this section.

Aringhi, Paul. *Roma subterranea.* 2 vols. Paris, 1659. 352 & 396 p. illust. fol. Pre-Linn. 1659.1

Fishes are dealt with. An earlier edition(?), 1651.

Aristotle [384-322 B. C.] For a memoir, see Crichton, Andrew, (In Jardine, (Sir) W. Naturalist's Library, 1836, vol. XIV, p. 17-112. *Ibid.*, [2nd issue], 1845-46.)

For critical commentaries on the work of the "Father of Natural History," see Agassiz, L. 1856.2, 1858.9, 1871.1; Burckhardt, C. R. 1905.2; Girod, P. 1880.1; Klunzinger, C. B. 1901.1; Scupin, E. 1905.1; Sonnenburg, L. 1857.1; Steier, A. 1913.2; Sundevall, C. J. 1863.1; Thompson, D. W. 1913.1; Vallot, J. N. 1838.1, 1839.1; Wiegmann, A. 1826.1. Also, Biese, F. Add. 1835.1; Camus, A. G. Add. 1783.1; Gill, T. N. Add. 1873.1; Heck, L. F. Add. 1885.1; Jourdain, A. Add. 1843.1; Langkavel, B. Add. 1863.1; Lewes, G. H. Add. 1864.1; Meyer, J. B. Add. 1855.1; Osborne, J. Add. 1840.1.

— *Aristotelis de animalibus libri ix; de partibus animalium libri iv; de generatione animalium libri v.* Latine, interprete [Theod.] Gaza. Venetiis, 1476. fol. Pre-Linn. 1476.1

The first printed edition of any of Aristotle's "Natural History." Other editions of this: Venice, 1492, 1498, & 1503. Copies in H., Y., L. C., H. E. H.

— *Historia animalium latine*, Th. Gaza interprete. Venetiis, 1492. Pre-Linn. 1492.1

A 2nd ed. of the above is dated Venice, 1498. Another ed., augmented by the works of other natural history writers, appeared at Venice in 1513.

— *Opera omnia.* 4 vols. Augsburg, 1479. fol. Pre-Linn. 1479.1

The first Latin edition of the "Opera." Other early Latin eds. are: Venice, 1489, 1496, 1550-52 (11 vols. fol.). Copies: H., P., J. H. U., U. C., H. E. H.

— *Opera omnia et nonnulla græce.* Aldus Manutius editor. 5 vols. Venetiis, 1495-1498. fol. Pre-Linn. 1495.1

The first Greek edition of Aristotle's works. Other eds. in Greek of the complete works are: Basle, 1531, 1550.

During the 15th century, six editions of the "Opera," the "Historia" or its parts, appeared at Venice; 1476, 1492, 1493, 1495, 1497, 1498. Of the same the 16th century saw at least 5 editions from Venice; as many from Paris; 4 from Leyden; 2 from Basel; and one each from Cologne, Florence, and Lyons. During the 17th and first half of the 18th centuries, editions appeared too numerous to be listed. Of comparatively recent editions, the following may be cited as standard:

Aristoteles Græce; ex recensione I. Bekkeri, etc. Edidit Academia Borussica. 5 vols. Berlin, 1831-70. 4°.

Aristoteles Thierkunde: Kritischberichtigter Text mit Deutscher Uebersetzung . . . und Sprachlicher Erklärung . . . von H. Aubert und . . . F. Wimmer. 2 Bd. Leipzig, 1868. illust. 8°.

Histoire des animaux d'Aristote traduite en Français et accompagnée de notes perpétuelles par J. Barthélemy-St.-Hilaire. 3 tom. Paris, 1883. 8°.

The works of Aristotle translated into English under the editorship of J. A. Smith, and W. D. Ross. Vol. IV. *Historia animalium* by D'Arcy Wentworth Thompson. Oxford, 1910. xv, folios 486a - 633a + index. 8°.

This is the best English translation, far superior to that by Thomas Taylor (1806.1) or that by Creswell (1883.1). For a critical estimate of both the two earlier English and of Thompson's newer version, see Gill, T. N. 1911.1.

Arkstee, —, & Merkus, —. *Allgemeine Historie der Reisen zu Wasser und Lande; oder Sammlung aller Reisebeschreibungen welche bis itzo in verschiedenen Sprachen von allen Völkern herausgegeben worden . . .* Durch eine Gesellschaft gelehrter Männer im Englischen zusammen getragen, und aus demselben ins Deutsche übersetzt. 21 vols. Leipzig, 1747-74. illust. 4°. Pre-Linn. 1747.1

"This work is a translation and extension of 'A new general collection of voyages and travels, etc.,' 1745-47, as well as of A. F. Prévost's 'Histoire générale des voyages.' The translation was begun by A. G. Kästner and J. J. Schwabe, and carried on by F. W. Beer, C. C. Woog, J. G. Müller, F. J. Bierling, and others." — Catalogue British Museum (Natural History).

Armstrong, John [—1758] *The history of the Island of Minorca.* London, 1752. xxvii, 260 p. 2 pls. 8°. Pre-Linn. 1752.1

Glossopetras, pp. 142-143. figs. Fishes, pp. 161-169.

2nd. ed., London, 1756. A French version is:

Histoire naturelle et civile de l'isle de Minorque, traduite sur la deuxième édition anglaise. Amsterdam & Paris, 1769. 2 pls. map. 12°.

There is also a German translation, Hamburg, 1771; while another appeared in the Göttingische Sammlung der Reisen.

Arnault de Nobleville, Louis Daniel [1701-1778], & **Salerne, François.** *Traité d'histoire naturelle des animaux, pour servir de suite à la matière médicale de Geoffroy.* 7 vols. Paris, 1756-1757. 12°. Pre-Linn. 1756.1

14 fishes described, vol. II, p. 347. Refers to fishes in medicine. Deals with voracity of pike, viviparity of eels, etc.

Arnold, Theodorus. (translator). *Eine Untersuchung des Ursprungs. und der*

Arnold, T.

Formirung der Fossilien, oder Fische-schalen und anderer dergleichen Körper so aus der Erden gegraben werden, . . . die zwei unterschiedenen Meynungen, nemlich dererjenigen, die solche vor die Exuvias, oder hinterlassene Schalen würcklicher Fische ausgeben, und derer, die sie vor Lusus Naturæ oder ein blosses Spiel der Natur halten, zu vergleichen. Leipzig, 1732. 8°.

Pre-Linn. 1732.1

Arrian, Flavius [fl. 2. cent. A. D.] *Historia* [Greek]. Pisauri [Pesano], 1508. fol.

Pre-Linn. 1508.1

Other eds. Basel, 1539; Venice, 1544 (Italian).

"Arrian's History furnishes us with some interesting details of an almost exclusively ichthyophagous community in India, and their wonderful skill, both in the manufacture and the use of nets made from the inner bark of palm-trees." — J. J. Ripley, 1883.

— De venatione. Græce et Latine; Luca Holstenio interprete. Parisiis, 1644. 4°.

Pre-Linn. 1644.1

Artedi, Peter [1705–1735] For biographies, see Eastman, C. R. 1905.5; & Lönnberg, A. J. 1905.7.

— *Ichthyologia, sive opera omnia de piscibus scilicet: Bibliotheca ichthyologica. Philosophia ichthyologica. Generum piscium. Synonymia specierum. Descriptiones specierum. Omnia in hoc opere perfectiora, quam antea ulla. Posthuma vindicavit, recognovit, coeptavit et edidit Carolus Linnæus. 5 parts. Lugduni Batavorum [Leyden], 1738. 8°.*

Pre-Linn. 1738.1

The separate parts of this work are thus entitled:

Pars i. *Bibliotheca ichthyologica sive historia litteraria ichthyologiæ in qua recensio fit auctorum, qui de piscibus scripsere, librorum titulis, loco & editionis tempore, additis iudiciis, quid quisvis auctor præstiterit, quali methodo et successu scripserit, disposita secundum sæcula in quibus quisvis auctor floruit.* iv, 66 p.

Pars ii. *Philosophia ichthyologica in qua quicquid fundamenta artis absolvit, characterum scilicet genericorum, differentiarum specificarum, varietatum et nominum theoria rationibus demonstratur, et exemplis corroboratur.* iv, 118 p.

Pars iii. *Genera piscium. In quibus systema totum ichthyologiæ proponitur, cum classibus, ordinibus, generum characteribus, specierum differentiis, observationibus plurimis. Redactis speciebus 242 ad genera 52.* iv, 88 p.

Pars iv. *Synonymia nominum (specierum) piscium fere omnium; in qua recensio fit nominum piscium, omnium facile authorum, qui unquam de piscibus scripsere: uti Græcorum, Romanorum, barbarorum, necnon omnium insequentium ichthyologorum una cum nominibus inquilinis variarum nationum.* iv, 118 p.

Pars v. *Descriptiones specierum piscium quos vivos præsertim dissecuit et examinavit, inter quos primario pisces Regni Sueciæ facile omnes accuratissime describuntur, cum non paucis aliis exoticis.* iv, 102 p.

"Artedi may be justly regarded as the father of modern ichthyology, having introduced a precise terminology, full and pertinent diagnoses, and throughout uninominal generic names." — T. N. Gill, *Smithson. Misc. Coll.*, 1872 (1874), no. 247, p. 28.

The subsequent editions of Artedi's work by Walbaum (1788–1793) and J. G. Schneider (1789) are noticed under the editors' names.

Ascham, Anthony [fl. 1553] *A prognostication and an almanacke joyned together declaryng the disposition of the people, and also of the wether, with certayne electyons and tymes chosen . . . for hawekyng, huntyng, fishyng and fowlyng, accordyng to the science of astronomy, made for the yeare of our Lorde God, MDL.* London [1549]

Pre-Linn. 1549.1

Ash, Thomas. *Carolina; or a description of the present state of that country, etc.* Published by T. Ash. gent. London, 1682. Pre-Linn. 1682.1

Among the fishes mentioned are sturgeon, mullets, salmon, trout, bass, drum, cat-fish, plaice and eels.

Asseler, Thomas. *Viridarium adriaticum; oder, der, um den venetianischen golfo, florierende lust-garten in welchem zu sehen seyn die schöne blumen &c., dero inligender insulen, allerseits, angrantzender lãnder, vornembste stãdt, gewächs, frũchten, thier &c. vorgestellt.* Augspurg, 1686. 110 p. 19 pls. maps. 16°.

Pre-Linn. 1686.1

A few fishes described. Copy, Arn.

Athenæus, Naucratis [fl. c. 200] For an essay on this author and the fishes referred to in his work, see Wellmann, 1888.1.

— *Deipnosophistarum libri xv.* Venice, 1514. fol. Pre-Linn. 1514.1

This, the *editio princeps*, is in Greek. Better known is the famous edition of 1524. Another very famous edition is:

— *Athenæi Deipnosophistarum lib. xv, cura et studio Isaaci Casuboni . . . auctiores emendatioresque editi. Cum interpretatione latina Jacobi Dalechampii, Cadomensis. Adjecti sunt indices rerum, scriptorum, proverbiorum, vocum accuratissimi.* Heidelbergæ, 1597. 702 p. fol.

Pre-Linn. 1597.1

Other early eds. are: Basel, 1535 (in Greek), 1556; Venice, 1556 (apparently the 1st Latin edition); Lyons, 1583, 1600, 1612, 1621, 1657, 1661; Geneva, 1597.

— Les xv livres de Deipnosophistes d'Athénée, traduits du grec en françois; par l'Abbé de Marolles. Paris, 1680. 4°. Pre-Linn. 1680.1

This is the best old edition issued at Paris. Other French editions are those of 1798, and that of 1819 in three volumes translated by Lefevre Villebrune.

Of modern issues, the one considered by Cuvier and by Brunet to be the best is that issued at Strassburg in 14 vols. by Schweighauser, 1801-07. A later edition and probably the best of all is that by Kaibel issued 1887-90.

An English translation by C. D. Yonge is to be found in Bohn's Classical Library, London, 1884, under the title "The deipnosophists or the banquet of the learned." In this translation, vol. I, book III, chaps. LXXXV-XCIV, fish as food; vol. I, book VI, chaps. I-XII, fishmongers and fishermen; vol. II, book VII, chaps. IV-CXL, some 85 or more fishes are referred to; book VIII, voices of fishes, fossil fishes, subterranean fishes, rain of fishes, fish eaters, restoration after freezing, sounds made by fishes, migration of fishes, amphibious fishes, particular fishes used for food, etc.

Athenæus, a Greek rhetorician of Naucratis, Egypt, was author of a number of works of which "The Banquet of the Learned" only is extant. It is an immense storehouse of miscellaneous information written in the form of the table talk of a number of writers and philosophers who were entertained at a great banquet by a wealthy patron of art and literature. Its great value is due to the fact that it is full of quotations from writers whose works are no longer extant, and who but for Athenæus, would be lost to us. He quotes 800 authors and 2500 separate writings.

"As a work of art it [the Deipnosophistarum] can take but low rank, but as a repertory of fragments and morsels of information, it is invaluable."

Aurivillius, Joh. (respond.) Dissertatio de natura piscium in genere, et piscatura. Holmiæ, 1676. 4°

Pre-Linn. 1676.1

Magnus Celsius, præses.

Ausonius, Decius Magnus [310-395] Ausonii Burdigalensis, viri consularis Mosella, edyllium tertia. Burdigale, 1580. fol. Pre-Linn. 1580.1

This idyll, entitled the "Mosella," was written about 370 A. D. It contains recognizable descriptions of the species of fish found in the Moselle, among them the brook and salmon trout.

— Mosella . . . commentario illustrata. Mussiponti, 1615. 8°.

Pre-Linn. 1615.1

A black letter edition with commentaries by Focher was printed at Heidelberg, 1619, in folio.

— Opera. Venice, 1472. fol.

Pre-Linn. 1472.1

The "Opera" of Ausonius have appeared in many editions of which this is the first. At least 10 editions are known *ante* 1758, the three earliest being; 1472, 1494, 1496. For further bibliographical details, see Westwood & Satchell.

The "Mosella" is contained also in "Poetarum Latinorum minorum," vol. I, p. 192, edited by Johann C. Wernsdorff, Altenburg, 1780.

Oken in Isis, 1845, columns 5-44, reprints the "Mosella" with a parallel German translation. He then identifies the 16 fishes of Ausonius, and gives many references to these fish in the writings of 16th and 17th century authors.

There is also a modern annotated edition by Hosius, published at Marburg in 1894, commented upon by J. Wimmer in his "Geschichte des deutschen Bodens," p. 322-384. Halle, 1905.

Modern editions of the Mosella in Latin and German were issued: Coblenz, 1802; Hamm, 1824; Berlin, 1828; Altona, 1832, and Cologne, 1837. The best German edition is probably that of Neumann, Trier, 1846; the best French, by Corpet, Paris, 1843.

B

B., A. P. F. Abentheuer von allerhand Mineralien, . . . Thieren, Vögeln, Fischen, . . . etc. Francofurti, 1656. 4°. Pre-Linn. 1656.1

Bacon, Francis (*Viscount St. Albans*) [1561–1626] *Sylva sylvarum, or a naturall historie, in ten centuries.* London, 1627. portr. fol. Pre-Linn. 1627.1

Other eds.: London, 1635, 1639, 1650, 1658, 1670, 1676 (10th ed.), 1677; Paris, 1631; Leyden, 1648; Amsterdam, 1661. Frequently reprinted since, especially in collected works, as: New York, 1864. 15 vols.

In the 14th ed. — Concerning marine fishes transferred to fresh water, p. 414; concerning scaly fishes, p. 535; fishes in general, pp. 103, 449, 493.

Baeck, Abraham [1713–1795] *De cornu piscis plane singularis carinae navis impactu observatio.* Acta Acad. Caes. Nat. Cur., 1748, 8, 199–217. Pre-Linn. 1748.1

Found also in Klein, J. T. in this section, 1740.1 (v. part).

Baerle, Caspar. See **Barlaeus, Caspar.**

Baker, Henry [1698–1774] [A letter concerning an extraordinary fish called in Russia quab [*Gadus lota* ?] and on the stones called carp's eyes.] Phil. Trans. Roy. Soc. London, 1748, 45, 174–180. Pre-Linn. 1748.1

Balbinus, Bohuslai. *Miscellanea historica regni Bohemiae.* 2 vols. Pragæ, 1679–1682. fol. Pre-Linn. 1679.1

De piscibus Bohemiae, vol. I, cap. 52–57.

— *Curiosa naturæ Arcana inclyti Regni Bohemiae, etc.* Pragæ, 1724. fol. Pre-Linn. 1724.1

Baldigara, Battista. *Ragionamento di meraviglis non mai dato in luce. Opera nuova, nella quale si tratta di pesci meravigliosi, che si trovano in diverse peschiere di acque dolci e salse, . . . delle guerre et armate da mare.* Venezia, 1752. 8°. Pre-Linn. 1752.1

Baldner, Leonhard. For accounts of the man and his book, see Bleicher,

— 1888.1; and Lauterborn, R. 1901.1.

— *Recht natürliche Beschreibung und Abmahlung der Wasser-Vögel, Fischen, vierfüssigen Thier, Insekten und Gerwirm, so bey Strassburg in den Wassern sind, die ich selber geschossen und die Fisch gefangen, auch alles in meiner Hand gehabt.* Leonhard Baldner, Fischer undt Hagmeister in Strassburg gefertigt worden. Strassburg, 1666. Pre-Linn. 1666.1

Two modern reprints have appeared. The first by Fr. Reiber is:

L'histoire naturelle des eaux Strasbourgeoises de Léonard Baldner (1666). Bull. Soc. Hist. Nat. Colmar, 1887, 1–114.

A modern German version with copious annotations, was published by R. Lauterborn under the following title:

Des Strassburger Fischers, aus dem Jahre 1666. Vogel- Fisch- und Tierbuch. Herausgegeben mit Einleitung und Anmerkungen. Ludwigshafen, 1903, xvi, 177 p.

The original MS. of this work, which is still extant in the Strassburg Public Library, bears this title:

Descriptit & depinxit pisces & aves, quæ in Rheno & circa Argentoratum reperiuntur. MSC coemit eques Willoughby, et passim inseruit Ornithologiæ suæ & Ichthyographiæ.

Balduin, Gottfried (*respond.*) *Exercitatio de generatione piscium.* Wittebergæ, 1667. 4°. Pre-Linn. 1667.1
Gottfried Thilo, *præses.*

Balk, Laurentius. *Museum Adolpho-Fridericianum* (In Linnæus, C. *Amœnitates Academicæ seu dissertationes variæ, etc.* Lugduni Batavorum, 1749, 1, 556–610. 2 pls.) Pre-Linn. 1749.1

Fishes, p. 589–604.

This first appeared as a thesis, Holmiæ, 1746. 48 p. 2 pls. Later in another ed. of the above, Erlangen, 1787.

Bapst, Michael. *Wunderbares Leib- und Wundarzneybuch.* 2 parts. Mülhausen, 1590. 8°. Pre-Linn. 1590.1

Blood of fishes considered. 2nd. ed., Eisleben 1597. 4°.

Baralis, Barth., & La Chambre, Fr. de. *Ergo carnes piscibus salubriores.* Paris, 1655. Pre-Linn. 1655.1

Title from Boehmer. Probably a medical dissertation.

Barbarus, Hermolaus [1454–1495] *Castigationes Plinianæ; emendatio in Melam Pomponium* [Rome?] 1492.

Pre-Linn. 1492.1

Other rare editions (some augmented by other inclusions) are: Rome, 1493; Milan, 1494; Cremona, 1495 & 1497; Venice, 1495; and Basel, 1534. Copies, 1492, 1493, 1495 eds. Y., L. C., U. C.

— *Compendium scientiæ naturalis ex Aristotele*. Venetiis, 1545. iii, 76 p.

Pre-Linn. 1545.1

— *Naturalis scientiæ totius compendium, ex Aristotele & aliis philosophis, H. Barbaro . . . auctore, innumeris, quibus antea scatebat, mendis nunc demum D. C. Gesneri . . . operae studio purgatum. Cui accessit, H. Wildenbergii Aurimontani in universam Aristotelis Physicam epitome*. Basileæ, 1548. 267 p. text ills. 8°.

Pre-Linn. 1548.1

For this author as editor of Pliny's "*Historia Naturalis*," see Barbarus, H. 1778.1.

Barbot, Jean [—1720] A description of the coasts of North and South Guinea; and of Ethiopia Inferior . . . containing a geographical . . . and natural history of the kingdoms, etc. (In Churchill, A., & J. Collection of voyages and travels, etc., vol. V. London, 1732. fol.) Pre-Linn. 1732.1

Descriptions and figures are given "of the several sorts of fish in the sea of [South] Guinea." There are also some notes on the habits of fishes, particularly of sharks and the remora.

Another edition, London, 1740.

— Abstract of a voyage to Congo river, or the Zair, and to Cabainde, in the year 1700. (In Churchill's Collection of voyages, 1746, vol. II, 497–590.)

Pre-Linn. 1746.1

Baricelli, J. C. *Pisces marinos salubriores et sapidiores esse fluminum piscibus* (In his *Hortulus genialis*. Bologna, 1617. 12°.) Pre-Linn. 1617.1

Other eds.: Bologna, 1621; Genève, 1623.

Barker, Thomas [fl. 1651] For biographical and bibliographical data of Barker and his books, see Westwood & Satchell, 1883.1; and Marston, R. B. 1894.1.

— Art of angling, wherein are discovered many rare secrets very necessary to be known by all that delight in that recreation. London, 1651. 12°.

Pre-Linn. 1651.1

Reprints appeared at London, 1653 & 1654. The 1651 version was again reprinted at London, 1820; the 1653 volume at Leeds, 1817. The standard edition, the true second, is:

— Barker's delight, or the art of angling. Wherein are discovered many rare secrets very necessary to be known by all that delight in that recreation, both for catching the fish, and dressing thereof. 2. ed. London, 1657.

Pre-Linn. 1657.1

Copy, N. Y. P.

Barlaeus or Baerle, Caspar [1584–1648] *Rerum per octennium in Brasilia et alibi nuper gestarum, sub præfectura illustrissimi comitis J. Mauritii, Nassoviæ, etc.* Amstelodami, 1647. 12, 340 p. fol.

Pre-Linn. 1647.1

1st ed. A second was issued with Piso's tract on the air, water and localities in Brazil. Clive, 1660. 8°.

Describes some Brazilian fishes.

Barlow, Francis [1626?–1702] *Severall wayes of hunting, hawking, fishing, according to the English manner, invented by Franc. Barlow, etched by W. Hollar*. London, 1671. 12 pls. obl. 4°.

Pre-Linn. 1671.1

The plates drawn by Barlow were etched by Hollar, who by some bibliographers is listed as joint author.

Barlow, William. A paper concerning the *Mola salviani* or sun-fish, and a glue made of it. *Phil. Trans. Roy. Soc.* London, 1740 (1744), 41, 343–345. pl.

Pre-Linn. 1744.1

Barnes or Bernes or Berners, Juliana or Julyans [c. 1388–] *Treatyse perteynyng to hawkyng, huntynge, and fysshynge with an angle: and also a ryght noble treatise of the lygnage of cot armours, endynge with a treatise which specyfeth of blasynge of armys*. Westmestre, 1496. fol. (black letter)

Pre-Linn. 1496.1

The authorship of "*The Book of St. Albans*" is generally ascribed to Dame Barnes, who is said to have been Prioress of Sopwell near St. Albans. This work is supposed to have been written early in the 15th century, but the first edition of it, which is entitled: "*The bookys of haukyng and huntynge: and also of cootamuris. Compylyt at St. Albons, 1486.*" contains nothing about fishing. The next edition (1496) contains the famous treatise on fishing, the earliest in the English language.

The "*Treatyse*" was republished in separate form about the year 1500 and at least fifteen editions of the whole work appeared before 1600, most of them being undated.

For careful descriptions and critical discussions of the various early editions of this old work, see Westwood and Satchell's invaluable "*Bibliotheca piscatoria*," p. 24–29 (1883.1); also Lowndes, W. T., "*A Bibliographer's Manual of English Literature*" revised and extended by H. G. Bohn, vol. I, 1864, pp. 117–118. For an analysis of the "*Treatyse of fyshynge with an angle*," with extensive quotations, see Marston, R. B. 1894.1, p. 15–32. For a critical discussion of "*The Book of St. Albans*," reference may be made to Haslewood, J., 1810.1.

Barnes, J.

— A jewell for gentrie. Being an exact dictionary, or true method, to make any man understand all the arts, secrets, and worthy knowledges belonging to hawking, hunting, fowling and fishing . . . London, 1614. 50 leaves. 4°. Pre-Linn. 1614.1

This work, published anonymously, is a plagiarized edition of the "Book of St. Albans." Copy in N. Y. P. is listed under Berners.

For a verbatim et literatim et punctuatim reprint of the 1496 edition, see:

The book containing the treatises of hawking, hunting, coat-armour, fishing and blasing of arms; as printed at Westminster by Wynkyn de Worde, 1496 [With biographical and bibliographical notices by Joseph Haslewood] London, 1810. illust. 8°.

Another reprint was issued at London in 1827, and especially notable is the facsimile issued at London in folio in 1880 with an introduction by M. G. Watkins. (See Barnes, Juliana. 1880.1.)

An American edition of the "Treatyse" was published in New York, in 1875, under the editorship of George W. van Sicken. Other reprints have been issued since this date; i. e., London, 1903, but need not be listed. Of interest, however, is the following:

An older form of the Treatyse of fysshynge wyth an angle attributed to Dame Juliana Barnes. Printed from a MS. in the possession of Alfred Denison; with preface and glossary by Thomas Satchell. London, 1883. (4), viii, 38, (10) p.

"The 'Treatyse' as given in this MS. differs considerably in orthography, phrase, and sense, from that in the 'Boke of St. Albans,' and Professor Skeat is inclined to assign to it an earlier date than 1450." — Dict. Nat. Biog.

Barrère, Pierre [1690?–1755] *Essai sur l'histoire naturelle de la France équinoxiale, ou dénombrement des plantes, des animaux et des minéraux qui se trouvent dans l'île de Cayenne, les îles de Remire, sur les côtes de la mer et dans le continent de la Guyane; avec leurs noms différents, latins, français et indiens, et quelques observations sur leur usage dans la médecine et dans les arts.* Paris, 1741. xxiv, 215 p. 8°. Pre-Linn. 1741.1

Fishes, pp. 169–172.

Another edition, identical save for changed title page, Paris, 1749. For a preliminary notice of this work, see *Mém. Acad. Sci. Paris*, 1741 (*Hist.*, p. 23). A partial translation is: "Neue Beschreibung von Guiana." *Göttinische Sammlung der Reisen*, 2. Bd.

— *Nouvelle relation de la France équinoxiale, contenant la description des côtes de la Guyane; de l'isle de Cayenne; le commerce de cette colonie; les divers changemens arrivés dans ce pays; et les mœurs et coutumes des différens peuples sauvages qui l'habitent.* Paris, 1743. 250 p. 3 maps. 16 pls. 12°. Pre-Linn. 1743.1

Bartholinus, Caspar [*Secundus, Thomæ filius*] [1655–1738] *De respiratione animalium disputatio.* Hafniæ, 1700. 12 p. 4°. Pre-Linn. 1700.1

— *De glossopetris dissertatio.* Hafniæ, 1704. 10 p. 4°. Pre-Linn. 1704.1

— The same, 2. ed. Hafniæ, 1706. 12° Pre-Linn. 1706.1

Bartholinus, Caspar [1585–1629] *Institutiones anatomicæ.* Albi, 1611. 8°. Pre-Linn. 1611.1

Reprinted: Wittenberg, 1611; Rostock, 1622, 1626; Strasburg, 1622; Goslar, 1632.

— The same. 2nd ed. Revised by Thomas Bartholin. Leyden, 1641. Pre-Linn. 1641.1

Often reissued: Leyden, 5 issues, 1645–1686; The Hague, 5 issues, 1655–1666; others (French), Paris & Lyons, 1647–1684. An English version is:

— Bartholinus anatomy; made with the precepts of his father, and from the observations of all modern anatomists. Published by Nich. Culpeper, and A. Cole, Doctor of Physick. London, 1668. 153 figs. fol. Pre-Linn. 1668.1

— (*præses*) *Dissertatio tetras quæstionum physicarum.* Lipsiæ, 1647. 2 pls. 4°. Pre-Linn. 1647.1

Bartholomæus, *respond.*

Question 3 discusses the respiration of fishes.

Bartholinus, Thomas [1616–1680] For a sketch of his life and a short analysis of his work, see Choulant, L. "Graphische Incunabeln für Naturgeschichte und Medicin. Bibliographie der Drucke des XVten und XVIten Jahrhunderts." Leipzig, 1858. 8°.

— *De unicornu observationes novæ.* Patavii, 1641. 8°. Pre-Linn. 1641.1

Deals with all unicorn (one horned) animals; "piscis monoceros" among them.

— *De luce animalium, libri III.* Leyden, 1643. Pre-Linn. 1643.1

Other editions are: Leyden, 1647; Copenhagen, 1669, & 1693.

— *De unicornu observationes novæ. Accesserunt de aureo cornu — O. Wormii.* Patavii, 1645. 304 p. illust. 8°. Pre-Linn. 1645.1

— *Historiarum anatomicarum et medicarum IV centuriæ.* 5 vols. Copenhagen, 1654–1661. 4°. Pre-Linn. 1654.1

i. *De pisce Illetif.* Cent. I, ep. 24, 107.

ii. *Anatome Xiphiae.* Cent. II, hist. 16, 196.

iii. *Orbis piscis anatome* [Tetrodon, Mola] Cent. II, hist. 1, 169.

iv. *Piscis figura crucis signatus* (passer piscis). Cent. II, hist. 33, 225.

v. *Orbes maiores marini* [Tetrodon, Mola] Cent. IV, hist. 34, 304.

— *De unicornu observationes novæ. Secunda editione auctiores emendatiores editæ a filio C. Bartolino. Amstelodami, 1678. xix, 381, 15, 40 p. illust. 12°.* Pre-Linn. 1678.1

Titles reading "unicorn" not seen, and entered doubtfully. However, Bartholin wrote about both the mammal [Narwhal] and the fish [Xiphias].

Bartholomæus, — (*respond.*) *Dissertatio tetras quæstionum physicarum. Lipsiæ, 1647. 2 pls. 4°.*

Casp. Bartholinus, præses.

Question 3 discusses the respiration of fishes.

Bartholomæus Anglicus [*fl.* 1230–1250] (Erroneously called Bartholomew de Glanville) For an analysis of his work and for brief data about the author, see Choulant, Ludwig. "Graphische Incunabeln der Naturgeschichte und Medecin . . . des XV und XVI Jahrhunderts." Leipzig, 1858. For critical data as to the dates of publication, see Sotheby, S. Leigh. "Principia typographica." 1858, 3, 89–104; Duff, E. G. "Wm. Caxton," Chicago, 1905, and "XV century English books," 1917; and Voigt, E. "Englische Studien," 1910, 41, 347. For an epitome in present-day English, see Steele, R. 1893.1.

— *De proprietatibus rerum. Coloniae et Basiliæ, (1470). 238 leaves. fol.* Pre-Linn. 1470.1

This famous compilation, the first edition of which is listed above, is the first encyclopædia ever printed. Before the invention of printing many MS. copies had been made, of which specimens are to be found in the libraries of the B. M., Paris (MS. dated 1376), the Vatican, Oxford and Cambridge Universities, and elsewhere. First printed in 1470, 1471, or 1472 at Cologne, and at Basel 1472, it sprang into great favor. Besides a number of undated versions, at least 26 editions, mostly in folio, were issued 1470–1495; 10 during the 15th century, and 3 from 1601–1619 — the date of the last edition ever published. These are distributed as follows: Cologne, 4, 1470–1483; Basle, 1, 1470; London, 4, 1471–1582; Lyons, 5, 1482–1500; Strasburg, 6, 1480–1505; Nuremberg, 5, 1483–1519; Harlem 3, 1484–1495; Toledo, 2, 1494 & 1529; Paris, 2, 1556 & 1573; Venice, 2, 1516, 1571; Frankfort, 3, 1601–1619, — and French and Dutch editions of 1472 and 1479 without place. For the above we have records; there are probably others still not listed.

Early foreign versions, including English, are:

— *Cy commence ung tres excellent livre nommé le propriétaire des choses; cestuy livre fut translaté de Latin en*

François Frère Jean Corbichon (en 1372), et a este revisité par Frère Pierre Ferget. Lyon, 1482. gr. fol.

Pre-Linn. 1482.1

— *Le propriétaire des choses. Lyon, 1485. fol.* Pre-Linn. 1485.1

— *Van den proprietiejen der dingen. Haarlem, 1485. fol.*

Pre-Linn. 1485.2

The earliest Dutch ed. was, however, 1479.

— All the propytees of thynges [John Trevisa translator] Westmestre, Wynkyn de Worde, 1494 [or 1495] fol.

Pre-Linn. 1494.1

The first English edition, and the first printed encyclopedia in the English language.

— *De los propiedades de las cosas. Toulouse (Tolosa ?), 1494. fol.*

Pre-Linn. 1494.2

— *De proprietatibus rerum* [Thomas Berthelet]. London, 1535. fol.

Pre-Linn. 1535.1

— Batman uppon Bartholome, his book de proprietatibus rerum, newly corrected, enlarged and amended, etc. London, 1582. fol. Pre-Linn. 1582.1

Batman was the Rev. Dr. Stephen Bateman, Chaplain to Bishop Parker. The edition is a re-issue of Wynkyn de Worde's 1494 version.

At the close of this volume is the following note: "Barthelmew Glanvyle, a Franciscan Frier, wrote this worke in Edward the Third's time, about the yeare of our Lord 1366 (1360 ?) — In the yeare 1397, 37 yeares after, was this sayd worke translated into English, and so remained by written coppie untill A. D. 1471, at which time printing began first in England, the 37 yeare of the Reign of King Henrie the 6; sithence this learned and profitable worke was printed by Thomas Berthelet, [London] 1535."

Copies of early editions are in H., Y., L. C., U. S. C., N. Y. P., J. C., & H. E. H.

Basilus Magnus (*Saint*) (*Basil the Great, Archbishop of Cæsarea in Cappadocia*). [329–379] *Hexameron* (in Opera [Greek]) Basiliæ, 1551. fol.

Pre-Linn. 1551.1

Fishes in Homily vii, § 5.

The above is the *editio princeps*. Other eds. of his works are: Basel, 1552, 1565; Leipsic, 1566; Ingoldstadt (Dutch), 1591; Paris, (Greek & Latin, 2 vols.), 1618. fol.; Paris & Basel, 1654.

Found also in:

— *Librorum LX. Ecloga sive synopsis, hactenus desiderata.* [Greek & Latin]. Basiliæ, 1575.

Pre-Linn. 1575.1

An English translation of the "Hexameron" by Rev. Blomfield Jackson is contained in the "Select lives of Nicene and post-Nicene fathers." 2. ser. New York, 1895.

Bassus, Cassianus (fl. 6th. & 7th. cents. A.D.) *Geoponica*. De re rustica selectorum libri xx. Græci Constantino quidem Cæsari nuncupati . . . J. A. Brassicani opera in lucem editi . . . Item, Aristotelis de plantis libri duo Græci . . . hac primum editione restituti (S. Grynæi Præfatio). Basileæ, 1539. xlvii, 551 p. 8°.

Pre-Linn. 1539.1

Attributed in some editions to Constantine IV, and in others to Constantine VII, Emperors of Constantinople, but now known to have been compiled by Bassus and to have been revised by an unknown editor and published (in MS.) about 950.

The 2nd ed. The first (in Greek) Basel, 1538. Other Latin eds. (at least 3), Venice, Basel, & Leyden (one in 1541); in Italian, Venice, 1542 & 1549; French, Poitiers, 1543.

— Der Feldbaw, oder das Buch von der Feldarbeyt. Vor tausent Jahren von dem . . . Keyser Constantino III inn Griechischer Sprach beschriben, unnd durch D. M. Herren verdolmetscht. Jetzund von newem widerumb uberlesen, gemehret und be bessert (with a preface by L. Rabus von Memmingen). Strassburg, 1551. ccxxvii, 24 p. 8°.

Pre-Linn. 1551.1

— *Geoponika*. *Geoponicorum, sive de re rustica, libri xx*. Cassiano Basso scholastico collectore. Antea Constantino Porphyrogenneto a quibusdam adscripto. Græce et Latine. Cantabrigiæ et Londonis, 1704. 8°.

Pre-Linn. 1704.1

Another and excellent edition, edited by J. J. Niclas, was published at Leipsic, 1781. A late English version by T. Owen was issued at London, 1805, under the title "Geoponica. Agricultural pursuits." For other modern editions, see *Encyclopædia Britannica*, 1910, vol. III.

The "Geoponica" is a compilation from the writings of various Roman writers on farming. The 20th book, consisting of 46 short chapters is devoted to fish and fishing.

Baulacre, —. *Oeuvres*. Band I. Genève, 1738–1756. Pre-Linn. 1738.1

Swiss fishes are considered.

Bayle, Francis [1622–1709] *Dissertationes* [Problemata] physicae, in quibus principia proprietatum in mixtus, oeconomia corporum in plantis et animalibus demonstrantur. Tolosæ, 1677.

Pre-Linn. 1677.1

Remora as a ship-holder; relative amounts of muscle and bone in fish, etc.

Other eds.: Toulouse, 1681 & 1701; The Hague, 1678.

Beal, John [1603–1683] [Account of shining fish] *Phil. Trans. Roy. Soc. London*, 1666, 1, 226–228.

Pre-Linn. 1666.1

First known account of putrefaction causing phosphorescence.

— On the effect of frost on eels. *Phil. Trans. Roy. Soc. London*, 1666, 1, 323. Pre-Linn. 1666.2

Beckmann, J. V. (præses) *Disputatio de jure piscandi*. Inaug. Dissert. Jenæ, 1676. 4 pls. 4°.

Pre-Linn. 1676.1

J. Volckhart, respond.

Beenius, Johannes (præses) *Piscis ille grandissimus, qui Jonam integrum devoravit*. Hafniæ, 1698. 4°.

Pre-Linn. 1698.1

Sever. Arctander, respond.

Beermann, Sigism. *Epistola in qua van der Hardt Jonas in Carcharia examinatur*. Wolfenbüttel, 1719. 8°.

Pre-Linn. 1719.1

Belon, Pierre [1517–1564] For a short sketch and account of his work, see Miall, L. C., 1912.1. For a larger biography with a full bibliography, see Morren, Edouard. "A la mémoire du Pierre Belon du Mans, 1517–1564." *Belgique Horticole*, 1885, 35, 1–29. portr.

— L'histoire naturelle des estranges poissons marins, avec la vraie peinture et description du dauphin et de plusieurs autres de son espèce, observées par Pierre Belon du Mans. Paris, 1551. 55 p. index. figs. 4°.

Pre-Linn. 1551.1

Other eds.: Paris, 1553 & 1555.

— *De aquatilibus libri duo*. Cum eiconibus ad vivam ipsorum effigiem, quoad eius fieri potuit, expressis. Parisiis, 1553. 16 leaves. 448 p. obl. 8°.

Pre-Linn. 1553.1

110 fishes are named and described. 2nd ed., 1620. fol.

— Les observations de plusieurs singularitez et choses mémorables, trouvées en Grèce, Asie, Indée, Egypte, Arabie & autres pays estranges, redigées en trois livres, par Pierre Belon du Mans Paris, 1553. 211 p. 4°.

Pre-Linn. 1553.2

The first ed. A second, revised and augmented, Paris, 1554. Others: Paris, 1555, 1558, 1585, 1588; Antwerp, 1555, 1558, 1589, 1605. The last ed. is dated 1620. Found also in Ray, J. "A collection of travels and voyages," etc. 1693.

Some fishes are mentioned, as for instance the parrot-wrasse, *Scarus*, which Aristotle had declared to be the only fish that ruminates. Accounts are given also of fishing by the peoples visited.

— *La nature et diversité des poissons, avec leurs pourtraicts, representez au plus près du naturel.* Paris, 1555. 448 p. illust. 12°. Pre-Linn. 1555.1

This is a translation into French of the "De aquatilibus," etc. Another edition, Paris, 1560.

— *Portraits d'oyseaux, animaux, serpens, herbes, arbres, hommes et femmes, d'Arabie & Egypte, observez par P. Belon du Mans.* Paris, 1557. 242 p. 220 woodcuts & maps. 4°. Pre-Linn. 1557.1

Another edition, 1618.

— *Plurimarum singularium et memorabilium rerum in Græcia, Asia, Aegypto, Judea, Arabia, aliisque exteris provinciis ab ipso conspectarum observationes tribus libris expressæ.* Raphelengii, 1605. 242 p. fol.

Pre-Linn. 1605.1

Translated from the French and edited by Carolus Clusius. Fish and fishing, pp. 15, 35, 71-73, 100.

Berkel, Adrian van. *Amerikaansche voyagien, behelzende een reis na Rio de Berbice, gelegen op het vaste land van Guiana, . . . mitsg. een andere na de colonie van Suriname enz. . . .* Amsterdam, 1693, viii, 139 p. pls. 4°.

Pre-Linn. 1693.1

Contains the first known description of *Gymnotus electricus*.

Berners, Juliana. See **Barnes, Juliana.**

Bernes, Juliana. See **Barnes, Juliana.**

Bernhardi, Fab. (respond.) *Exercitatio physica de respiratione piscium, quam statuunt nonnulli.* Jenæ, 1656. 4°.

Pre-Linn. 1656.1

Melchior Zeidler, *præses*.

Besler, Basil [1561-1629] *Rariora musei Besleriani quæ olim B. et M. R. Besleri collegerunt, æneisque tabulis ad vivum incisa evulgarunt: nunc commentariolo illustrata a J. H. Lochnero &c.* Norimbergæ, 1716. xiv, 112 p. 41 pls. fol.

Pre-Linn. 1716.1

Fishes, pp. 55-68. Fossil fishes, p. 93-94. Glossopetras, p. 105. All with figures.

The contents of this Museum were collected and were figured on copper by B. and M. R. Besler and the descriptive text written by J. H. Lochner von Hummelstein. See also Besler, M. R., & Lochner von Hummelstein, J. H. Copy, A. M. N. H.

Besler, Michel Rupert [1607-1661] *Gazophylacium rerum naturalium, e regno vegetabili, animali & minerali depromptarum, nunquam hactenus in lu-*

cem editarum, fidelis cum figuris æneis ad vivum incisis representatio. Opera Michælis Ruperti Besleri Medici. Leipzig, 1642. pls. fol. Pre-Linn. 1642.1

Other eds.: Leipzig & Frankfurt, 1716 & 1733.

A rare work containing copper plates of fishes, birds and mollusks, without text.

— *Rariora musei Besleriani quæ olim Basilus et Mich. Rup. Besler collegerunt æneisque tabulis ad vivum incisa evulgarunt: nunc commentariolo illustrata a Joh. Henr. Lochnero, denuo luci publicæ commisit . . .* Mich. Frid. Lochner. Norimbergæ, 1716. 22 & 112 p. 40 pls. fol. Pre-Linn. 1716.1

Seven fishes are figured and described, p. 55-68. Fossil fishes, p. 93-94. Glossopetras, p. 105.

See also Besler, B., & Lochner von Hummelstein, J. H.

Bianchi, Giovanni [1693-1775], pseudonym for **Plancus, Janus**.

Bingen, Hildegarde (Abbess of) See **Hildegarde de Pinguia**.

Binnell, Robert. *Description of the river Thames . . . with the City of London's jurisdiction and conservancy thereof . . . to which is added a brief description of those fish, with their seasons, spawning times, etc., that are caught in the Thames, or sold in London. With some few observations on the nature . . . peculiar to fish in general, etc.* London, 1758. 8°.

Pre-Linn. 1758.1

See Griffith's "An essay to prove, etc.," 1746, of which this is a plagiarized copy. See also Binnell, R. 1785.1.

Birch, Thomas (editor) [1705-1766] *History of the Royal Society in London.* 4 vols. London, 1756-57. 4°.

Pre-Linn. 1756.1

In the form of printed minutes, an account is given of the proceedings with short abstracts of papers read.

Birckerodius, Thomas Broderus. *Sciagraphia . . . sive de cornibus et cornutis commentariorum, quos ex omni antiquitate, scientia et arte collectos, sex libris distinctos . . . quadrupedum, piscium . . . aliarum rerum, ultra mille, illustratos publico destinavit, et brevi, volente Deo, legendos dabit.* Hafniæ, [ante 1694]. 28 p. 4°.

Pre-Linn. 1694.1

Blacuod, Henr., & Debonnaire, Jo. *Ergo pisces febricitantibus carnibus salubriores.* Paris, 1587.

Pre-Linn. 1587.1

Title from Boehmer.

Blagrove, Jos. [1610–1682] The epitome of the art of husbandry. Comprising . . . directions for the use of the angle, etc. London, 1669. 12°. Pre-Linn. 1669.1

Other eds.: London, 1675; 1685; 1719.
In the 1685 ed., fishes and fishing cover 13 pages.

Blasius, Gerard [c. 1623–1682] Observationes anatomicæ selectiores, editæ e collegio medicorum privatorum Amstelodamensis. Amsterdam, 1667. 12°. Pre-Linn. 1667.1

Contains observations on the viscera of fishes.

A later ed. is:

— Observationum anatomicarum collegii privati Amstelodamensis, pars altera, in quibus præcipue de piscium pancreate ejusque succo agitur. Amsterdam, 1673. 12°. Pre-Linn. 1673.1

— Anatome animalium, terrestrium variorum, volatilium, aquatili-um, serpentum, insectorum, ovorum-que, structuram naturalem ex veterum, recentiorum, propriisque observationibus proponens, figuris variis illustrata. Amstelodami, 1681. 494 p. 60 pl. 4°. Pre-Linn. 1681.1

One of the earliest books on comparative anatomy. The internal structure of a considerable number of fishes is taken up in some detail, p. 259–308, and in 6 plates. Copy, N. Y. P.

Blégnny, Nic. de [1652–1722] De pisce remora. Zodiacus-medico-gallicus, 1682, an. iv, 92. Pre-Linn. 1682.1

Blome, Richard [—1705] The gentleman's recreation. In two parts; the first being an encyclopedia of the arts and sciences . . . the second part treats of horsemanship, . . . fishing and agriculture, etc. London, 1686. fol. Pre-Linn. 1686.1

Another ed. appeared in 1710 in folio.

— Present state of his majesties isles and territories in America. London, 1687. Pre-Linn. 1687.1

Fisheries, pp. 20, 38, 79, 118, 135, 165, 189, 239, 250–252. French translation, Amsterdam, 1688; German, Leipzig, 1697.

Bluntschli, —. Memorabilia Tigurina. Merkwürdigkeiten der Stadt und Landschaft Zürich 1742. Zürich, 1742. 713 p. 4°. Pre-Linn. 1742.1

Contains data on fishes of Zurich.

Boccone, Paulo afterwards *Sylvio* [1633–1704] Recherches et observations

naturelles touchants le corail . . . les dents de poissons pétrifiées . . . la sangsue du Xiphias, etc. Paris, 1670. 16 pls. 12°. Pre-Linn. 1670.1

Other eds.: (French) Amsterdam, 1671, 1672, 1674; (Italian) Bologna, 1684; (German) Frankfurt, Leipzig, & Jena, 1697; (Dutch) Amsterdam, 1744 or 1745.

— Recherches et observations naturelles sur la production de plusieurs pierres, sur la pétrification de quelques parties d'animaux, sur les principes des glossopètres, sur la pierre étoilée et sur l'embrasement du Mont Etna. Paris, 1671. 12°. Pre-Linn. 1671.1

— [A not ordinary sanguisuga or leech, found sticking fast in the Xiphias or sword-fish]. Phil. Trans. Roy. Soc., 1673, 8, 6159–6160. Pre-Linn. 1673.1

— Museo di fisica, e di esperienze variato e decorato di osservazioni naturali, . . . Con una dissertazione dell'origine e della prima impressione delle produzioni marine, etc. Venezia, 1697. viii, 319 p. 18 pls. 4°. Pre-Linn. 1697.1

"De Glossopetris, p. 179; de Lavareto & Sallione piscibus rarioribus, p. 289."

— Descriptio anatomica *Canis carchariæ*. (In Valentini, M. B. Amphitheatrum Zootomicum, Francofurti, 1720, pt. 2, p. 120–121. pl. 70) Pre-Linn. 1720.1

Reprinted from "Recherches et observations naturelles," p. 327. First figure of teeth tiger shark.

— Natuurkundige naspeuringen op proef- en waarnemingen gegrond. Zynde behalven een uitvoerige navorssing . . . van de oorzaak der wonderbare versteningen van verscheide lighamen. 's Gravenhage, 1745. pls. 8°. Pre-Linn. 1745.1

A Dutch version of 1697.1

Bocer, Henricus (*præses*) Disputatio de domino proprietatis et ejus acqui- rendi modus . . . et quidem de venatione, piscatione et inventione. Inaug. Dissert. Tubingæ, 1599. 4°. Pre-Linn. 1599.1

Casper Henchelin, *respond.*

Bochart, Samuel [1599–1667] Hierozoicon seu de animalibus S. Scripturæ compendium in duas partes divisum quarum prior iv libris animalia in genere, quadrupedes domesticas, feras & oviparis. Posterior vi libris aves mundas, immundas, serpentes, insecta,

aquatica, fabulosa animalis pandit a Stephano M. Vecseo adornatum. Franekeræ [Franeker], 1619. 4°.

Pre-Linn. 1619.1

Second and enlarged ed. is:

— Hierozoicon seu de animalibus S. Scripturæ opus bipartitum, cujus pars prior libris iv de animalibus in genere, & de quadrupedibus viviparis & oviparis: pars posterior libris vi de avibus, serpentibus, insectis, aquaticis & fabulosis animalibus agit. 2 vols. Londini, 1633. fol. Pre-Linn. 1633.1

Other eds. of this very learned work are: London, 1663; Frankfort, 1667 & 1675; Franeker, 1690; Leyden & Utrecht, 1712; Leipsic, 1793-96 (3 vols.).

— Opera. Lugduni Batavorum & Ultrajecti, 1692. fol.

Pre-Linn. 1692.1

Other eds.: Leyden, 1722; Leipsic, 1799.

In the 1793-96 issue (edited by E. F. C. Rosenmüller), vol. III, chap. xii contains Jonah's whale (argued to be a *Carcharias* shark); chap. xiii, the *Zygæna* shark; chap. xiv, the Tobias fish.

Bock, Hieronymus (vulgo *Tragus*) [1498-1554] New Kreutter Buch, von Unterscheydt, Würckung und Namen der Kreutter, so in teutschen Lande wachssen. Auch derselbigen eygentlichen und wolgegründten Gebrauch in Arzney &c. 2 vols. (in 1). Strassburg, 1539. vi, 174; 88, iv p. fol.

Pre-Linn. 1539.1

Other eds.: Strassburg, 1551, 1556, 1557 — all folio. A later ed.:

— Von den vier Elementen, zamen und wilden Thieren, auch Vögeln, Fischen, und allerhandt Gewürz. (In his Herbarium. Argentorati, 1577, pt. iv, 397-350. fol.) Pre-Linn. 1577.1

— Kreütterbuch, darin Unterscheidt, Nammen, und Würckung der Kreütter, . . . Item von den vier Elementen, zamen und wilden Thieren, auch Vögeln, und Fischen, &c. &c. Strassburg (1587?). liv, 454, 46 p. ills. fol. Pre-Linn. 1587.1

Edited and augmented by Melchior Sebizium. A still later edition, Strassburg, 1630.

Bodin, Jean [1530-1596] Commentarius in Oppianum de piscium natura & venatione. Lutetiæ, 1555. 4°.

Pre-Linn. 1555.1

— Universæ naturæ theatrum in quo rerum omnium effectrices causæ et fines contemplantur et discutiuntur. Lugduni, 1596. 8°. Pre-Linn. 1596.1

— Le théâtre de la nature universelle. Lyon, 1597. 8°.

Pre-Linn. 1597.1

Natural history and habits of fishes, pp. 460-480.

Other eds.: Frankfort, 1597 & Hannover, 1605.

Copies, 1597 eds., Col.

Böckler, G. A. Nützliche Haus- und Feldschule. Wie man ein Land- und Feld-Guth und Meyery mit aller Zugehöre mit Nutzen anordnen solle. 2 parts. Frankfurt, 1669. pls. 4°.

Pre-Linn. 1669.1

Bol, J. Venationis, piscationis et aucupii typi. c. 1600. obl. 4°.

Pre-Linn. 1600.1

"Contains 43 plates engraved by Philip Galle from the celebrated paintings by J. Bol, representing hunting, fishing, shooting, falconry, etc." W. & S. Copy, N. Y. P.

Bonanni, Filippo. See **Buonanni, F.**

Bonge, Dan. (respond.) Dissertatio de salmonum naturâ, eorumque apud Ostrobothnienses piscatione. Upsala, 1730. 27 p. fig. 4°. Pre-Linn. 1730.1

Laurence Roberg, præses.

Bontius or Bondt, Jac. [Jan] [1599-1631] De medicina Indorum libri iv, etc. Lugduni Batavorum, 1642. 212 p. Pre-Linn. 1642.1

11 fishes described.

Appended to W. Piso's "De Indiæ utriusque re naturali et medica, etc.," 1658, under the title:

— Historiæ naturalis et medicæ Indiæ orientalis libri vi. Amstelædami, 1658. Pre-Linn. 1658.1

Also reprinted under original title in Alpinus, P., "Medicina Aegyptiorum, etc." 1718 & 1745. An English version is:

Account of the diseases, natural history, and medicines of the East Indies. London, 1769. 8°. This contains no descriptions of fishes but treats of fish as food, p. 122-127.

Bondt was the first author to describe fishes from Batavia, in which city he lived and practiced medicine.

Bontius, Jac., Piso, Gul., & Markgraef, Geo. Oost- en West-Indische warande, vervattende aldaar de leef- en geneeskunst. Met een verhaal van de specerijen, boom- en aardgewassen, dieren etc. in O. en W. L. voorvallende. Amsterdam, 1694. viii, 304, viii, 96 p. 8°. Pre-Linn. 1694.1

Bontius on the use of fish as food and medicine, p. 14-20. Nothing by either Piso or Markgraef, who are little referred to.

Copy, N. Y. A. M. 2nd ed., Amsterdam, 1734.

Boodt, Anselm Boethius de [1550–1634] *Gemmarum et lapidum historia. Hanoviae*, 1609. figs. 4°. Pre-Linn. 1609.1

Glossopetras, liber iv, p. 301 & 343.

Other eds.: Bruges, 1609; Lugduni Batavorum (edited by A. Tollius) 1636 & 1647; Lyon, 1644. A French ed. is entitled:

— *Le parfait joaillier ou histoire des pierreries* [annotated by André Toll] Lyon, 1649. ills. Pre-Linn. 1649.1

De la Glossopetra, etc., p. 435–437. Copy, N. Y. P.

Bordone, Benedetto. *Isolario*. 1527. Pre-Linn. 1527.1

Some West Indian fishes are mentioned.

See also Santa Cruz, "El yslario general de todas las yslas del mundo," written c. 1544, and edited by Franz R. von Wiesel, in his "Karten von Amerika." Innsbruck, 1908.

— *Libro di Benedetto Bordone nel qual si ragiona de tutte l'isole del mondo con li lor nomi antichi & moderni, historie, favole, & modi del loro vivere, & in qual parte del mare stanno, & in qual parallelo & clima giacciono.* Venice, 1528. 83 leaves. Pre-Linn. 1528.1

Other eds.: Venice, 1534, 1537, 1547. These & 1528 ed. in J. C. B.

Borelli, Giovanni Alphonso [1608–1679] *Philosophia de motu animalium ex principio mechanico-statico*. 2 vols. Romæ, 1680–1682. 168 p. figs. 4°. Pre-Linn. 1680.1

Borelli studied the mechanism of swimming and determined the function of the swim bladder.

Other eds. are: Leyden, 1685, 1710, 1711; Naples, 1734; The Hague, 1742 & 1743. The full title of the latter is:

— *De motu animalium. Edit. nova, ac dissertationibus physico-mech. de motu musculosum etc.* J. Bernoulli aucta et ornata. 2 parts. Hagæ, 1743, 222, 18 & x, 270, 14 p. 20 pls. Pre-Linn. 1743.1

Borrich, Olaus [1626 or 27–1690] *De aci marini anatome [Belone vulgaris]* Acta. Med. Phil. Hafnien. (Bartholini), 1673 (1675), 2, 149–151. Pre-Linn. 1675.1

Reprinted in Valentini, M. B. "Amphitheatrum Zootomicum." 1720, pt. 2, p. 119.

Original not seen. Agassiz assigns this title to Jacobæus, O. (Pre-Linn. 1675.1); Carus & Engelmann, to Borrich, O; while both Walbaum & Gronovius list it under both authors.

Bosman, Willem. *Nauwkeurige beschryving van de Guinese Goud-Tanden Slave-kust, etc.* 2 vols. [in 1] Trajecti, 1704. xxvi, 208, 280 p. illust. 4°. Pre-Linn. 1704.1

Other eds.: Dutch, Amsterdam, 1709, 1718, & 1737; Italian, Venice, 1752–54. Titles of known foreign versions follow.

— A new description of the coast of Guinea . . . written originally in Dutch . . . and now faithfully done into English, etc. London, 1705. viii, 493 p. 7 pls. map. 8°. Pre-Linn. 1705.1

A second English ed. was issued in 1721. Bosman's work is also reprinted in Pinkerton's "Collection of voyages." 1814, vol. XVI.

— *Voyage en Guinée, contenant une description de cette côte, des animaux, des oiseaux, des poissons, etc.* Utrecht, 1705. pls. 8°. Pre-Linn. 1705.2

— *Reyse nach Guinea, etc.* Hamburg, 1708. xii, 590 p. 4 pls. Pre-Linn. 1708.1

Bossche, Gulielmus van den. *Historia medica, in qua libris iv animalium natura et eorum medica utilitas exacte et luculenter tractantur.* Bruxellæ, 1639. xiv, 434, 20 p. ills. 4°. Pre-Linn. 1639.1

Fishes, p. 319–386.

Bosman, Wilhelm. See **Bosman, Willem.**

Bossow, P. *Quæstiones juris de venatione, aucupio et piscatione.* Basle, 1618. 4°. Pre-Linn. 1618.1

Boucher, P. *Histoire véritable et naturelle des mœurs et productions du pays de la Nouvelle France; vulgairement dite le Canada.* Paris, 1664. xxiv, 168 p. ills. 12°. Pre-Linn. 1664.1

Names are given of the fishes which are found in the St. Lawrence, and in the lakes and rivers tributary to it.

Boussuet, Franciscus [1520–1572] *De natura aquatiliu carmen in universam Gulielmi Rondeletii, quam de piscibus marinis scripsit historiam; cum vivis eorum imaginibus. Opusculum nunc primum in luce emissum.* Lugduni, Gallorum, 1558. 240 p. ills. 4°. Pre-Linn. 1558.1

— *De natura aquatiliu carmen, in alteram partem G. Rondeletii de aquatilibus historiae.* Lugduni, 1558, 135 p. ills. 4°. Pre-Linn. 1558.2

These rare works form a pictorial history of fishes. Rondelet's figures are used and each has beneath it a short Latin verse in epigrammatic form describing the fish. They are generally bound together, but each has its own title page and separate pagination.

Bowlker, Richard. The art of angling, improved in all its parts, especially fly-fishing. Worcester, (1746?). 12°. Pre-Linn. 1746.1

This famous work, revised by the author's son, Charles, passed through a large number of eds. In the Heckscher sale catalogue, 1909, 12 issues are listed; 1758-1854.

See also Bowlker, R., 1758.1.

Boyle, Robert [1627-1691] For a sketch of his life by Thomas Birch, see edition of works below, 1744.

— New experiments concerning the relation between light and air (in shining wood and fish), etc. Phil. Trans. Roy. Soc. London, 1667, 2, 591-600.

Pre-Linn. 1667.1

Phosphorescence of dead fish in a vacuum.

— Of the motion of the separated heart of a cold animal (*Anguilla*) in the exhausted receiver. Phil. Trans. Roy. Soc. London, 1670, 5, 2027-2028.

Pre-Linn. 1670.1

— Of the phænomena of a scale-fish in an exhausted receiver. Phil. Trans. Roy. Soc. London, 1670, 5, 2024-2026.

Pre-Linn. 1670.2

— Philosophical works abridged, methodized and disposed under the general heads of physics, statics, pneumatics, natural history, &c. 3 vols. London, 1725. figs. 4°. Pre-Linn. 1725.1

Other eds.; 1738, 1744 (with the life of Boyle by Thomas Birch), & 1772.

Boyle, Roger [c. 1621-1679] Occasional reflections upon several subjects, whereto is premis'd a discourse about such kind of thoughts. London, 1665. 12°. Pre-Linn. 1665.1

Contains data about fish and fishing.

2nd ed., 1669. Reprinted, London, 1808; Oxford, 1848.

Attributed by Westwood & Satchell to Hon. Robert Boyle. Copy in N. Y. P. written by Roger Boyle [1st Earl of Orrery ?]

Braccio, Ignacio. Remoræ pisciculi effiges. Romæ, 1634. 1 p. fig. fol.

Pre-Linn. 1634.1

No copy of this work, consisting of one page with woodcut, seems extant. There was formerly a copy in the British Museum, a part of the Sir Hans Sloane collection, but it has been lost.

Bradley, Richard [—1732] A philosophical account of the works of nature, etc. London, 1721. xx, 194 p. 28 pls. 4°. Pre-Linn. 1721.1

Fish ponds and breeding of fish are treated of, p. 178-181.

A 2nd ed.: London, 1739.

— The country gentleman and farmer's monthly director . . . Wherein is directed the . . . breeding and feeding of . . . fish, swine, and all sorts of cattle. London, 1726. 8°.

Pre-Linn. 1726.1

— Wysgeerige verhandeling van de werken der natuure. Amsterdam, 1744. 31 pls. 8°. Pre-Linn. 1744.1

Brander, Fredrik Reinhold (respond.) Dissertatio de regiâ piscaturâ Cumo-ensi. Inaug. Dissert. Aboæ, 1751. 48 p. 2 pls. 4°. Pre-Linn. 1751.1

Carl Fred. Menander, præses.

For other works on husbandry by this author, see Catalogue British Museum (Natural History). All these presumably have chapters dealing with fish ponds and fish culture.

Brassicatus, Johannes Alexander. [1500-1539] De re rustica selectorum libri xx Græci . . . J. A. Brassicani opera in lucem editi, &c. 1539. 8°.

Pre-Linn. 1539.1

See also Bassus, C., Pre-Linn. 1539.1.

Brauner, Johann. Beschreibung der Fischer-Zäune und ihres Gebrauchs. König. Schwed. Akad. Abhandl., 1753, 15, 277. Pre-Linn. 1753.1

See note under Kästner, A. G., Pre-Linn.

— Beskrifning på fiske-katsor och deras nyttjande. K. Svensk. Vetensk. Acad. Handl., 1753, 14, 272.

Pre-Linn. 1753.2

Breton, Nicholas [c. 1545-1627] Wit's-Trenchmour; in a conference had between a scholler and an angler. London, 1597. sm. 4°.

Pre-Linn. 1597.1

This is said to have furnished the idea of Walton's "Angler."

Breton, Raymond [1609-1679] Dictionnaire Caraïbe-François. Auxerre, 1665. Pre-Linn. 1665.1

Contains Carib names for fishes and other natural history objects.

Facsimile reprint by Jules Platzmann, Leipzig, 1892.

Brickell, John. The natural history of North Carolina . . . Illustrated with copper plates, whereon are curiously engraved the map of the country, several strange beasts, birds, fishes, snakes, insects, trees, and plants, etc. Dublin, 1737. 408 p. woodcuts, pls. map. 8°. Pre-Linn. 1737.1

Of the fish of North Carolina, pp. 215-249. 2nd ed.: Dublin, 1743.

Bring, Sven. (præses) Dissertatio de piscaturis in Oceano Boreali.

Bring, S.

Londini Gothorum [Lund], 1750. 29 p. 4°. Pre-Linn. 1750.1

Carl Estenberg, *respond.*

Brisson, Mathurin Jacques [1723–1806] *Système naturel du règne animal, par classes, familles ou ordres, genres et espèces, avec une notice de tous les animaux etc. suivant la méthode de Klein; avec une notice de celle de Linnaeus, et l'ordre des poissons, suivant la division d'Artedi et l'ordre des oursins de mer.* 3 vols. Paris, 1754. 10 pls. 8°. Pre-Linn. 1754.1

Not seen. Said to be a translation of a (to us unknown) work by J. T. Klein. Often confused with a similar work by La Chesnaye Desbois (1754.1, q. v.)

Brockelsby, Richard [1722–1797] *Upon the sounds and hearing of fishes, by J. T. Klein, or some account of a treatise entitled "An inquiry into the reasons why the author of an epistle concerning the hearing of fishes endeavors to prove they are all mute and deaf."* Phil. Trans. Roy. Soc., 1748 (1750), 45, 233–239. Pre-Linn. 1750.1

Brodd, Andrew. (*respond.*) *Ichthyologiae biblicae pars prima, de ave selav, cujus mentio fit num. xi: 31, in qua contra Bochartum & Ludolfum non avem aliquem plumosam, nec locustam fuisse, sed potium quoddam piscis genus (piscis volatiles) manifestis demonstratur argumentis.* Upsaliae, 1705. 148 p. figs. Pre-Linn. 1705.1

Olaus Rudbeck (junior), *praeses.*

Brohon, Joannes. *De stirpibus vel plantis ordine alphabetico digestis epitome . . .* [2. ed.] per J. Brohon . . . edita. Cui accesserunt volatilium, gressilium, piscium . . . apud Gallias nomen, per Leodegarium a Querco. Parisiis, 1543. 65 p. 4°. Pre-Linn. 1543.1

First ed.: 1541.

This is based on a similar work by Leodegarius de Querco (q. v.).

Bronzer, Johann Hieronymus. *Disputatio de principatu hepatis ex anatome lampetræ.* Patavia. 1626. 4 p. 4°. Pre-Linn. 1626.1

Brookes, Richard [fl. 1750] *The art of angling, rock and sea-fishing, with the natural history of river, pond, and sea-fish.* London, 1740. 133 figs. 12°. Pre-Linn. 1740.1

First ed.: 2nd, London, 1743. An enlarged ed. is:

The art of angling. New improved with additions, and formed into a dictionary. In two

parts. I. Containing an account of fish and fish-ponds: a new art of fly-making: the new laws that concern angling: the secret ways of catching fish by ointments, pastes and other arts: directions how to procure baits, and for making all sorts of fish-tackle, with the surest method of finding sport, etc. London, 1766. viii, 292 p. 136 figs.

Many later eds., at least 15 up to 1811.

Brown, Edward. *A brief account of some travels in Hungaria, Servia, Bulgaria, Macedonia, Thessaly, Austria, Styria, etc.* London, 1673. 4°. Pre-Linn. 1673.1

Hungarian fishes, p. 10–12; fishes of the Danube, p. 109–110. figs.

Pagination in parts. Other eds.: London, 1677, 1685; French, Paris, 1674, 1684; Dutch, Amsterdam, 1682; German, Nürnberg, 1686, 1711, 1750.

Browne, Patrick [c. 1720–1790] *The civil and natural history of Jamaica.* In three parts. Containing . . . A history of the natural productions, including the various sorts of native fossils . . . London, 1756. viii, 503 p. 49 pls. map. Pre-Linn. 1756.1

The author, a physician of Jamaica, describes in this work 93 species of fishes, arranged after the Artedean system. His observations are regarded by Cuvier as much better than those of Sloane for the same fauna.

2nd ed.: London, 1789. fol. (See Browne, P., 1789.1)

Browne, Peter [c. 1665–1735] *A letter from a clergy-man in Ireland; giving an account of the taking of great numbers of fish, and of many sea-monsters, in the county of Clare, in that kingdom . . .* London, 1721. 42 p. 4°. Pre-Linn. 1721.1

Browne, (Sir) Thomas [1605–1682] *For a notice of his work as a naturalist, see Nicholson, W. A. 1900.1.*

— *Enquiries in the vulgar errors.* London, 1646. fol. Pre-Linn. 1646.1

This curious and interesting book contains some data about fishes.

Other eds. are: London, 1650, 1658, 1664, 1666 (2 issues), 1672, 1686; Frankfurt & Leipsic, 1668 (German); Paris, 1733 (French). A modern ed., London, 1852, in N. Y. P.

— *Certain miscellany tracts.* 1684. vi, 215 p. 8°. Pre-Linn. 1684.1

Tracts iii and iv treat of fishes.

Many later editions have appeared.

For his notes on the fishes of Norfolk (not published until after 1758), see Browne, Sir T., 1835.1 & 1902.1.

A modern ed. of his works was issued Edinburgh, 1912, 3 vols. sm. 8°.

Brückmann, Franz Ernst [1697–1753] *Specimen physicum exhibens historiam naturalem oolithi seu ovariorum piscium et concharum in saxa*

mutatorum. Helmstadt, 1721. 28 p. 4°. Pre-Linn. 1721.1

— *Observatio de lactibus et ovis in uno carpione*. Comm. Lit., Norimberg, 1734, 177. Pre-Linn. 1734.1

— *De figura lapidum ex pisci quodam Indico, cum effigio St. Petri, St. Peterstein genannt*. Comm. Lit., Norimberg, 1739, 209. fig. Pre-Linn. 1739.1

— *Von den Schlampeiskern oder Wetter-Fischen*. Hamburg. Ber. Gelehrt. Sachen, 1741, 633. Pre-Linn. 1741.1

— *De glossopetris et chelidoniis* (In his *Centuria epistolarum itinerarium*. Wolfenbüttel, 1742, 1. cent., epist. 29) Pre-Linn. 1742.1

— *De vermibus quibus Helgoland ad piscatum hamatitem utuntur*. Comm. Lit., Norimberg, 1742, 381. fig. Pre-Linn. 1742.2

— *Bibliotheca animalis oder Verzeichniss derer meisten Schriften, so von Thieren und deren Theilen handeln, was hievon sowohl Theologi, Icti, Medici, Historici, als auch Chymici, Physici und Jäger geschrieben, nach alphabetischer Ordnung*. Wolfenbüttel, 1743. 277 p. 8°. Pre-Linn. 1743.1

— *Bibliotheca animalis continuatio*. Wolfenbüttel, 1747. 8°. Pre-Linn. 1747.1

— *Petrefactum singulare dentem seu palatum piscis ostracionis referens*. Act. Nat. Cur., Nürnberg, 1752, 9, 116-120. Pre-Linn. 1752.1

Brückner, Emil Daniel. Versuch einer Beschreibung historischer und natürlicher Merkwürdigkeiten der Landschaft Basel. 5 vols. Basel, 1748-63. 3076 p. figs. 101 pls. 8°. Pre-Linn. 1748.1

Various notes on fishing. p. 554, 632, 648.

Bruckmann, Fridericus. Tractatus III de venatione, piscatione et aucupio. Spiræ, 1605. 4°. Pre-Linn. 1605.1

Westwood and Satchell, Artdi, and Boehmer write the name as above, but the former also list the same book under *Prueckmannus*, Fr.

Bruyn, Cornelius [1652-1719] *Reizen door de vermaardste deelen van Klein Asia, de eylanden Scio, Rhodus, Cyprus enz. mitsg. de voornaamste steden van Aegypten, Syrien, en Palas-*

tina, etc. Delft, 1698. xx, 398 p. 210 pls. portr. fol. Pre-Linn. 1698.1

Various fishes are figured and described. Versions in French and English are:

— *Voyage au Levant*. Delft, 1700. pls. fol. Pre-Linn. 1700.1

In another French ed. of the above (1714), there is in chap. LVIII, p. 309, a description of fossil fishes found at Tripoli.

— *Voyage to the Levant*. London, 1702. pls. & map. fol. Pre-Linn. 1702.1

— *Reysen over Moscovien door Persien en Indien*. Amsterdam, 1711. pls. fol. Pre-Linn. 1711.1

Contains data about various fishes. This is a new work, not an edition of the preceding. Another Dutch ed.: 1714. French and English versions follow.

— *Voyages par la Moscovie, en Perse et aux Indes Orientales, ouvrage enrichi de plus de 300 tailles douces des plus curieuses representent les animaux, les oiseaux, les poissons et les plantes, . . .* Amsterdam, 1718. 320 pls. fol. Pre-Linn. 1718.1

— *Travels into Muscov, Persia, and part of the East Indies*. 2 vols. London, 1737. Pre-Linn. 1737.1

The accounts of the voyages of this author appeared together in a French ed. in 5 vols. Rouen, 1725. 4°.

This author was a painter, not a naturalist, and his drawings and descriptions of fishes are more interesting than valuable.

Bruyn, Niklaas de [1570-1641] *Libellus varia genera piscium complectens, pictoribus, sculptoribus, utilis et necessarius*. N. de Bruyn inventor. [Amsterdam, 1630?] 13 pls. 4°. Pre-Linn. 1630.1

Thirteen plates of fishes engraved by Bruyn, and published by Claes Janssen Vischer.

Bry, Theodor de [1528-1598], **Bry, Johann Theodore de** [1561-1623], & **Bry, Johann Israel de** [-1611]. *Collectiones peregrinationem in Indiam orientalem et Indiam occidentalem (Grands et petits voyages)*, 25 parts. Frankfort-am-Main, 1596-1634. Pre-Linn. 1596.1

For a collation of the "Voyages," see Lindsay, J. L. (Earl of Crawford and Balcarres) in his "Bibliotheca Lindesiana" no. 3, 1884. fol.; also Catalogue British Museum (Natural History), 1903, vol. I, 270-273.

Buonanni, or Bonanni, Filippo [1638-1725] *Museum Kircherianum sive Museum a P. Athanasio Kircherio in Collegio Romano Societatis Jesu jam pridem incoeptum, nuper restitutum*

Buonanni, F.

tum, auctum, descriptum et iconibus illustratum. Romæ, 1709. xii, 522 p. 172 pls. fol. Pre-Linn. 1709.1

Glossopetras, p. 201. Fossil fishes, p. 202. Fishes [dog, hammerhead, saw, sword, shark, ray, flying], p. 268-270. Scales of fishes, p. 360. pls.

For the first description of the contents of Kircher's museum, *see* Kircher, A., Pre-Linn. 1678.2.

The present work appeared in revised and enlarged form as:

Rerum naturalium historia, nempe quadrupedum, insectorum, piscium variorumque marinarum corporum, fossilum, plantarum exoticarum ac præsertim testaceorum existentium in Museo Kircheriano edita iam a P. Philippo Bonannio nunc vero nova methodo distributa notis illustrata in tabulis reformata novisque observationibus locupletata a Iohanne Antonio Battarra Ariminiensi philosophiæ professore. Pars prima. Romæ, 1773. xl, 260 p. 47 pls. fol.

Piscium squamæ, p. 90-93, pl. 33. De piscibus, p. 153-166, pls. 37-39.

The text (Pars Prima — all published) is by Buonanni; the annotations by Battarra, J., 1773.1 (q. v.)

Burckhard, Jacob. (*præses*) Disputatio juridica de piscatione. Basel, 1684. 6 pls. 4°. Pre-Linn. 1684.1

M. J. Koleffel, *respond.*

Burgundius, Vincentius. *See* Vincent de Beauvais.

Burrish, Onslow. Batavia illustrata, or A view of the policy and commerce of the United Provinces, particularly Holland. . . 2 vols. London, 1728.

Pre-Linn. 1728.1

A brief account of the manner in which the Dutch carry on the herring fishery, p. 569-576. Other eds.: London, 1731 & 1742.

Burton, Robert or Richard. Miracles of art and nature, or a brief description of the several varieties of birds, beasts, fishes, &c. of other countreys. London, 1678. 12°. Pre-Linn. 1678.1

4th ed., 1708. 10th, 1737.

Byam, (Rev.) Francis. An account of the impression on a stone dug up in the island of Antigua, etc. Phil. Trans. Roy. Soc. London, 1755 (1756), 49, 295-296. pl. Pre-Linn. 1756.1

The fossil fish here described is refigured by C. R. Eastman in Mem. Carnegie Mus., 1914, 6, 346-348, and named by him *Mene novæ-hispaniæ*, from Eocene.

C

C., A. Bibel-erklärende Kupfer, darauf alle zur jüdischen Geschichte gehörige Dinge, als Thiere, Fische, Bäume, Kräuter, Blumen und Früchte grötentheils mit natürlichen Farben nach dem Leben vorgestellt werden, nebst einer kurzen Erklärung aus den besten Schriftstellern. Danzig, 1756. 4°. Pre-Linn. 1756.1

C., C. H. B., & M., C. The perfect husbandman, or the art of husbandry. London, 1658. 4°. Pre-Linn. 1658.1
Pages 346–355 deal with fishes.

Caesarius, Johannes. Plinii libri II de piscibus cum scholiis. Venetiis, 1518. 4°. Pre-Linn. 1518.1

Caille, — (*Abbé de la*). Observations faites à l'isle de l'Ascension, sur le local, sur les oiseaux, la pêche, la longitude, etc. Mém. Acad. Sci. Paris, 1754, hist., 110; mém., 126. Pre-Linn. 1754.1

Caius, John [1510–1573] De rario-
rum animalium et stirpium historia,
liber unus. (In his De canibus britan-
nicis. Londini, 1570, p. 37–122.)
Pre-Linn. 1570.1

Several fishes are described.
Other (English) eds.: London, 1724 & 1729;
(German) Nuremberg, 1685, & Leyden, 1731.

Camellus, George Joseph. See **Kamel, G. J.**

Camerarius, Joachim (the younger)
[1534–1598] Symbolorum et emblematum
ex aquatilibus et reptilibus desumpto-
rum centuria quarta, a J. C.
. . . cœpta: absoluta post ejus obitum
a L. Camerario, etc. Norimbergiæ,
1604. 4°. Pre-Linn. 1604.1

Emblems 29, 30, 31 and 37 are drawings of
fishing subjects.

— Symbolorum et emblematum ex
aquatilibus et reptilibus desumptorum
centuria quarta. Francofurti, 1654.
Pre-Linn. 1654.1

Forty-six plates and descriptions of fish and
fishing.

— Symbolorum emblematum ex re
herbaria et animalibus desumptorum

centuriæ IV. 4 partes. Francofurti,
1661. 400 figs. 4°. Pre-Linn. 1661.1

The first edition, 1590–97, consisting of three
centuriæ only, has no fishes. The first full edi-
tion seems to be 1604.

Others, Frankfurt, 1605, 1672; and Mainz,
1668 & 1677. Each edition seems to have been
an augmented one.

Camerarius, born of a medical family in
Nuremberg, became a famous physician of that
city. He was the author of several books mainly
dealing with medicinal remedies.

Camerarius, Joach. 400 Wahl-
Sprüche und Sinnenbilder, und zwar
von . . . Fischen, etc. Maynz, 1671.
figs. 8°. Pre-Linn. 1671.1

Camerarius, Joannes Rudolphus.
Sylloge memorabilium naturæ, XX
centuriæ. Tubingæ, 1624–52.
Pre-Linn. 1624.1

A later ed. is entitled:

— Sylloges memorabilium medi-
cinæ et mirabilium naturæ arcanorum
centuriæ XX. Editio altera, emendata
et quatuor centuriis postumis aucta.
Tubingæ, 1683. 1662 p.
Pre-Linn. 1683.1

i. Quod pisces respirent casu inventum,
pisces in aere diu vivere nequeunt. Cent. VII,
pt. LXXVII, p. 486.

ii. Anguillæ etymon, sine parente, sine sexu,
sanitati inimica, cur ex anguillarum cadaveribus
anguillæ gignantur. Cent. IX, pt. xv, 652.

iii. Barborum piscium caro esui an utilis.
Cent. IX, pt. x, 645.

iv. Cur pisces mortui aquis innatant, vivi ad
fundum stabulant. Cent. IX, pt. xviii, 655.

v. Cyprinorum ortus spontaneus. Cent. IX,
pt. viii, 645.

vi. Lucii etymon, crudelitas, ortus, elegans
spectaculum ranæ ulciscens Lucii violentiam.
Cent. IX, pt. x, p. 647; 649.

vii. Remora piscis, ore navim sistit, inquisi-
tio causæ ob quam Echeneis moretur naves,
Rondeletii opinio de vi remoræ, et Fracastorii de
Echineide opinio refellitur et Scaligeri asseritur.
Cent. IX, pt. i, 635.

— An Tinca, umbilico applicata,
an Rubia conspecta icteritiam sanare
possint. (In Sitonius, Joannes Baptista.
Miscellanea medico-curiosa, etc. [2d.
ed.] Coloniz Agrippinæ, 1677, p. 140.)
Pre-Linn. 1677.1

Camilli, Chilini. Tallinæ vallis ac
larii lacus particularis descriptio. (In

Camilli, C.

Thesaurus antiquitatum et historiarum Italiae. Basileæ, 1561, 3, [5 p.] fol.)

Pre-Linn. 1561.1

Fish-fauna of lake Como and its tributaries.

Campbell, John [1708–1775] An exact and authentic account of the greatest white-herring-fishery in Scotland, carried on yearly in the island of Zetland, by the Dutch only, etc. Edinburgh, 1750. iv, 33 p. sm. 8°.

Pre-Linn. 1750.1

Some copies of the 2nd ed., published in 1753, have the title "A true and exact description of the island of Shetland." etc.

Reprinted, Edinburgh, 1885. 6, iv, 33 p. 12°.

Camper, Peter [1722–1789] Ob die Fische alle taub und stumm seyn. Stuttgart. Sel. Phys. Oecon., [c. 1756], 1, 405.

Pre-Linn. 1756.1

Candidus, Decembris Peter (also styled **Piercandido Decembrio**) [1399–1477] De animantium naturis ac rebus memoria et annotatione dignis. Editi a Candido feliciter D. L. 1460.

Pre-Linn. 1460.1

74 fishes are described.

This illustrated codex is preserved in the Vatican library. A modern rendition with present day identifications and many notes is:

Killermann, Seb. Das Thierbuch des Petrus Candidus geschrieben 1460, gemalt im 16. Jahrhundert. (Codex Vaticanus Urb. lat. 276). Zool. Annalen, 1914, 6, 113–221. 8 pls.

Cardano, Girolamo [*Hieronymus*] [1501 or 08–1576] For memoirs, see Mantovani, V. "Vita di Girolamo Cardano, Milanese philosopho, medico, e letterato." Milan, 1821; also Morley, Henry, "The life of Girolamo Cardano of Milan, physician." 2 vols. London, 1854.

— De subtilitate libri XXI, etc. Basilæ, et Lugduni, 1550, xlvii, 305 p. fol.

Pre-Linn. 1550.1

The *editio princeps*. Reprinted Paris & Leyden, 1551; Basel & Leyden, 1553. True 2nd ed., Basel & Leyden, 1554. 3rd ed. in Latin, Basel, 1560. Many other eds. (at least 13) of this popular work were issued 1561–1664; 12 before 1584. French versions, Paris, 1556 and 1584; Rouen, 1642; German, Basel, 1559.

Considerable data about various fishes are given.

— De rerum varietate libri XVII. Basilæ, 1557. xii, 707, 32 p. ill. fol.

Pre-Linn. 1557.1

First ed. Others: Basel, 1557, 1564, 1580, 1581; Avignon, 1558; Leyden, 1580 — *editio recognita*.

The anatomy of several fishes is described in book VII.

— Hieronymi Cardani Mediolanensis philosophi ac medici celeberrimi

Operum, tomus tertius; quo continentur physica, etc. Lugduni, 1564.

Pre-Linn. 1564.1

Cap. 37. "Piscium differentiae ac genera," p. 112–139.

Other eds. of the "Opera": Geneva, 1624; Leyden, 1663. (10 vols. each.)

Carleson, Eduard. Aufmunterung zur Einrichtung einer Fischerey in Schweden. Stockholm. Mag. 1754, 1, 107.

Pre-Linn. 1754.1

Casseri, Jules [1545–1616] De vocis auditusque organis historia anatomica. 2 vols. (in 1). Ferrariae, 1601. ill.

Pre-Linn. 1601.1

— Pentæstheseion, hoc est de quinque sensibus liber, organorum fabricam, actionem et usum continens. Venetii, 1609. 354 p. figs. fol.

Pre-Linn. 1609.1

Other eds.: Venice, 1627; Frankfort, 1610, 1612, 1632.

— Nova anatomia, continens accuratam organorum sensilium, etc. Frankfort, 1622.

Pre-Linn. 1622.1

In all these works, Casseri, the pupil and successor of Fabricius ab Aquapendente, describes the eye and ear of various fishes; the pike particularly.

Cassiodorus, Magnus Aurelius [c. 490–585] For a sketch of his life and works, see A. Franz (Breslau, 1872), who says of Cassiodorus: "One can with perfect fairness claim for Cassiodorus the honor of first having brought into cloister life the fostering of science."

— Opera [*editio princeps*]. Paris, 1579.

Pre-Linn. 1579.1

Other early eds.: Orleans, 1622; Rouen, 1679; & Venice, 1729. The "Epistolæ" therein contained have many notes on fishes and their habits. Among the fishes is the Exormiston, which has been identified by Dr. T. N. Gill as a *Leptocephalus*.

For a present day version of the "Epistolæ" with a good index, see:

"The letters of Cassiodorus, being a condensed translation of the 'Variæ' epistolæ of Magnus Aurelius Cassiodorus." Translation with introduction by Thomas Hodgkin. London, 1886. 560 p. 12°.

Castrillo, Hernando. Historia y magia natural, o ciencia de filosofia oculta, con nuevas noticias de los mas profundos misterios, y secretos del universo visible, en que se trata de animales, pezes, etc. Madrid, 1692. 14, 342, 16 p. 8°.

Catesby, Mark [1679–1749] The natural history of Carolina, Florida, and the Bahama islands; containing the

figures of birds, beasts, fishes, serpents, insects and plants; . . . Together with their descriptions in English and French. . . . To the whole is prefixed a new and correct map of the countries treated of . . . 2 vols. London, 1731-43. col. pls. Pre-Linn. 1731.1

A second edition of this justly famous work was issued at London, 1754, and a third in 1771. Both were revised and edited by George Edwards. A French version is "*Histoire naturelle de la Caroline, Floride, etc.*" Nuremberg, 1770. gr. fol. A German edition of the plates only, by Eisenberger, N. F., & Lichtensteger, Georg (q. v.) is:

— *Piscium, serpentum, insectorum aliorumque nonnullorum animalium nec non plantarum quarundam imagines quas M. Catesby in posteriore parte splendoris illius operis quo Carolinæ Floridæ et Bahamensium insularum tradidit historiam naturalem eiusque appendice descripsit. Additis vero imaginibus piscium tam nostratium quam aliarum regionum auxerunt, et vivis coloribus pictas. Ediderunt N. F. Eisenberger et Georg. Lichtensteger. Norimbergæ, 1750. 46 p. 109 pls. fol. Pre-Linn. 1750.1*

A second ed. of this was issued Nuremberg, 1777, in folio. (See Catesby, M., 1777.1)

— *Beschreibung von Carolina, Florida und den Bahama Inseln. Nürnberg, 1756. map. gr. fol. Pre-Linn. 1756.1*

This early German version is recorded by Engelmann only. Agassiz lists an "Appendix," London, 1748. fol. Neither has been seen by us.

Cato, Marcus Porcius [B. C. 234-149] *De re rustica*. Basilæ, 1521. 82 p. 8°. Pre-Linn. 1581.1

Contains instructions on the care and rearing of fish in ponds.

— *M. P. Catonis de agricultura, sive de re rustica, liber: post ultimam A. Popmæ editionem . . . Item fragmenta ejusdem scriptoris, ab A. Popma diligenter collecta, restituta. Lugduni-Batavorum, 1598. 8°. Pre-Linn. 1598.1*

The best ed. is: "*M. P. Catonis de re rustica curante J. M. Gesner.*" Mannheim, 1781. 105 p. 8°. See also in Gesner, J. M. "*Scriptores rei rusticæ veteres Latini, etc.*" 1787, vol. I. 8°.

Cato, M., Varro, Marcus Terentius, Columella, L. Junius Moderatus, & Palladius, Rutilius. *Libri de re rustica*. Parisiis, 1533. 506 p. fol. Pre-Linn. 1533.1

Other eds.: Paris, 1543; Lugduni, 1549; Leipzig, 1794-95.

See also, Anon. Pre-Linn. "*Scriptores rei rusticæ.*"

Cats, Jacob [1577-1660] *Alle de wercken, se ouden als nieuwe, van de Heer Jacob Cats, Ridderondt Raedtpen Lionaris van Hollandt, etc.* Amsterdam, 1655. fol. Pre-Linn. 1655.1

In "*Emblemata moralia et œconomica*" are three drawn from fishing; nos. 2, 7, and 39.

Other eds.: 1660, 1665, 1712, & 1726.

— *'t Ondekte voordeel van alle wereldsche dingen, afgedeelt volgens de wetten der natuur, en natuurlycke saken, in de vermeerderde wyse jaerbeschryver, verstandige huys-houder, ervaren landt-bouwer, enz.* Amsterdam, 1663. 4°. Pre-Linn. 1663.1

Catching salmon with nets and with the hands, pt. III, 182-184.

Caub, Johann v. See **Cube or Cuba, Johann v.**

Celsius, A. (præses) *Dissertatio de novo in fluviis Norlandiarum piscandi modo. Om et nyt sät at fiska i Norländska elfwar. Inaug. Dissert. Upsaliæ, 1738. 28 p. pl. 4°. Pre-Linn. 1738.1*

A. Hellant, respond.

Celsius, Magnus (præses) *Dissertatio de naturâ piscium in genere, et piscaturâ. Holmiæ, 1676. 4 p. 4°. Pre-Linn. 1676.1*

Joh. Aurivillius, respond.

Cerutus, Benedictus. *Musæum Fr. Calceolarii Jun. Veronensis, a Ceruto inceptum, et ab A. Chiocco luculenter descriptum et perfectum. Veronæ, 1622. figs. fol. Pre-Linn. 1622.1*

Pisces, p. 62-98 (in alphabetical order), 2 figs. Fossil fish & fig., p. 428.

See also Chiocco, A., Pre-Linn. 1622.1.

Champlain, Samuel de [1567-1635] *Les voyages du Sieur de Champlain Xaintongeois . . . Devises en deux livres, ou journal très-fidèle des observations faites es descouvertes de la Nouvelle France, etc.* Paris, 1613. Pre-Linn. 1613.1

— *Voyages et descouvertes faites en la Nouvelle-France, depuis l'année 1615 jusques à la fin de l'année 1618.* Paris, 1619. Pre-Linn. 1619.1

— *Les voyages de la Nouvelle France occidentale dicte Canada, faits par le Sr. de Champlain . . . & toutes les decouvertes qu'il a fait . . . [1603-1629]* Paris, 1632. Pre-Linn. 1632.1

A revised edition of the above works. This was included (with a biographical sketch of Champlain) by Abbé Laverdière in his "*Œuvres de Champlain,*" etc. 6 vols. Paris, 1870. Available for English readers as:

Champlain, S.

The voyages and explorations of Samuel de Champlain [1604-1616] Narrated by himself. Trans. by Annie Nettleton Bourne. Edited with [biographical] introduction and notes by Edward Gaylord Bourne. 2 vols. N. Y., 1906.

Champlain's voyages contain many references to fish and fishing. Garpike and its habits first described in book II, chap. ix.

Chapelle, —, de la. Observation sur un poisson, qui ressemble à peu près à une truite qui fait l'effet d'un baromètre. Mém. Acad. Sci. Paris, 1666-1686 (1733), 1, hist., 424.

Pre-Linn. 1733.1

Charleton, Gualtier or Walther [1619-1707] Exercitationes de differentiis & nominibus animalium, cum mantissa de variis fossilium generibus; deque differentiis ac nominibus colorum. Oxoniæ, 1667. fol.

Pre-Linn. 1667.1

— Onomasticon zoicon, plerorumque animalium, differentias & nomina propria, pluribus linguis exponens. Cui accedunt mantissa anatomica; & quædam de variis fossilium generibus. Londini, 1668. 12 figs. 4°.

Pre-Linn. 1668.1

P. 119-165, 224 fishes briefly described with Greek, Latin, and colloquial names. Bones of fossil fishes, p. 256. Glossopetra, p. 262.

Other eds.: London, 1671, 1674, 1763; Oxford, 1678. Copy 1668 ed. in A. M. N. H.

— Gualteri Charltoni exercitationes de differentiis & nominibus animalium. Quibus accedunt mantissa anatomica, et quædam de variis fossilium generibus, deque differentiis & nominibus colorum. Editio secunda, duplo fere auctior priori, novisque iconibus ornata. Oxoniæ, 1677. 309 p. 17 pls. fol.

Pre-Linn. 1677.1

An enlarged ed. of 1667.1. Pisces, pp. 1-106.

Charlevoix, Pierre François Xavier de [1682-1761] Histoire et description générale du Japon. 2 vols. Paris, 1736. pls. 4°.

Pre-Linn. 1736.1

In vol. II, supplement, 16 species of fish are described. The figures are copied after Kämpfer. 2nd ed., in 9 vols.: Paris, 1754. figs.

— Journal d'un voyage . . . dans l'Amérique septentrionale, etc. (Histoire de la Nouvelle France. Vol. III.) Paris, 1744. 8°.

Pre-Linn. 1744.1

Fishes of St. Lawrence river and lake Champlain; fishing for gar pike and sturgeon in lake Champlain; eel fishing in Canada.

This "Histoire" as a whole or in parts passed through a number of eds.: Paris, 1749; Leyden, 1750 (Dutch); Göttingen & Amsterdam, 1750; The Hague, 1760; London, 1761; and more recently New York, 1865.

Chasler, Hug., & Seguyn, Pet. See Seguyn & Chasler.

Chauffour, Jacques de. Instruction sur le faict des eaux et forêts, contenant en abrégé les moyens de les gouverner et administrer suivant les ordonnances des roys. Rouen, 1618. 8°.

Pre-Linn. 1618.1

Has some data on fishes and fish-ponds.

Cheselden, William [1688-1752] Osteographia or the anatomy of the bones. London, 1733. 20 folios. 56 copper plates. fol.

Pre-Linn. 1733.1

Skeleton of ray, and jaws and teeth of pike, Scarus and glossodont.

Chetham, James (of Smedley) [1640-1692] The angler's vade-mecum; or, a compendious yet full discourse of angling: discovering the aptest methods and ways, exactest rules, properest baits and choicest experiments for the catching all manner of freshwater fish . . . etc. London, 1681. 180 p. 12°.

Pre-Linn. 1681.1

This, the 1st ed., was published anonymously; 2nd ed., London, 1689, 326 p.; 3rd, London, 1700, issued by two publishers simultaneously.

Chetham was a writer of much originality. Copy, 2nd ed., N. Y. P.

Chevalier, Jean Damien [1700-1770] Lettres à M. de Jean . . . I. Sur les maladies de St. Domingue. II. Sur les plantes de la même île. III. Sur le Remore et les Halcyons. Paris, 1752. ii, 224. p. 8°.

Pre-Linn. 1752.1

Chiocco, A. Musæum Fr. Calceolarii Jun. Veronensis, a Ceruto incœptum, et ab A. Chiocco luculenter descriptum et perfectum. Veronæ, 1622. figs. fol.

Pre-Linn. 1622.1

Pisces, p. 62-98 (in alphabetical order), 2 figs. Fossil fish & fig., p. 428.

See also Cerutus, Benedictus, Pre-Linn. 1622.1.

Chomel, Noël. Dictionnaire économique; contenant divers moyens d'augmenter son bien, et de conserver sa santé, etc. 2nd ed. 2 vols. Paris, 1718. fol.

Pre-Linn. 1718.1

The 1st ed. not known to us. The third, Paris, 1767. An English version is entitled:

— Dictionnaire économique, or the family dictionary. Done into English. Revised and recommended by R. Bradley. 2 vols. London, 1725. fol.

Pre-Linn. 1725.1

Contains descriptions of different nets for catching all sorts of fish.

Churchill, Awnsham, & Churchill, John. A collection of voyages and travels, etc. 6 vols. London, 1704-1732. illust. fol.

Pre-Linn. 1704.1

Cirino, Andrea [1618–1664] *Liber secundus de natura piscium, in quo Platonis ac cæterorum philosophantium oracula; maris admiranda; piscium natura, virtutes, medicina, monstra et miracula ex probatissimis scriptoribus breviter expenduntur.* Panormi [Palermo] 1653. 552 p. 4°.

Pre-Linn. 1653.1

Clauder, Gabriel [1633–1691] *Thermometrum vivum (a pisce desumto)* Misc. Acad. Nat. Cur., 1687, dec. 2, an. 6, observ. 175, p. 354. fig.

Pre-Linn. 1687.1

— *Thermometri vivi nomen tribetur Cobitidi pisciculo.* Act. Regiæ Soc. Sci. Upsal., 1742, 79.

Pre-Linn. 1742.1

Cleghorn, George [1716–1789] *Observations on the epidemical diseases in Minorca.* London, 1751. 8°.

Pre-Linn. 1751.1

A number of fishes named.

A German version is: *Beschreibung der Insel Minorca.* Gött. Samml. der Reisen., 8. Th.

Clemente, Africo. *Della agricultura libri sei, coll' aggiunta del libri intorno alle pescagioni.* Vicenza, 1673. 16°.

Pre-Linn. 1637.1

Fishing occupies 9 chapters.

Other eds.: Trèves, 1677, 1696; Venice, 1714.

Clusius, Carolus [Gall. *Charles de l'Escluse*] [1526–1609] For a biography see Marven, C. J. "Charles de l'Escluse, sa vie et ses œuvres. 1526–1609." Bull. Fédérations Soc. d'Horticult., 1874; also separate, Liège, 1875. 59 p. 8°; also Roze, Ernest. "Biographie et correspondance, [suivies d'un rapprochement historique entre Charles de l'Escluse et Parmentier]." Paris, 1899. sm. 8°.

— *Exoticorum libri x; quibus animalium, plantarum, aromatum, aliorumque peregrinorum fructuum historiæ describuntur; item Petri Bellonii observationes, eodem Carolo Clusio interprete.* Antverpiæ, 1601. figs. fol.

Pre-Linn. 1601.1

Not seen. Title from Bosgoed. Better known is:

— *Exoticorum libri decem; quibus animalium, plantarum, aromatum, aliorumque peregrinorum fructuum historiæ describuntur. Item Petri Belonii observationes, eodem Carolo Clusio interprete.* Antverpiæ, 1605. viii, 378 p. 273 woodcuts. fol.

Pre-Linn. 1605.1

Sixteen fishes are described and shown in curious woodcuts, pp. 135–144. Fishing with the cormorant, p. 106.

A French version is:

— *Histoire des drogues, épiceries et de certains médicamens simples qui naissent des Indes, tant Orientales qu'Occidentales.* Lyon, 1619. 8°.

Pre-Linn. 1619.1

Cneiff, Johan David. *Tanckar huru en tilbörig Landthushållning skyndsammast synes kunna uphjelpas i Oesterbottn, wälment yppade af . . . och til trycket befordrade af Riksens Högloflige Ständers Manufaktur-Contoir.* Linköping, 1757. 333 p. 12°.

Pre-Linn. 1757.1

Treats of fish-culture.

Cockayne, Benjamin. *Rules for angling.* 33 folios. MS.

Pre-Linn. 1670.1

The original MS. is said to have been written in 1670. Transcript in N. Y. P.

Coenen, Adriaan. *Vischboek van Adriaan Coenen, zoon van Schilperoort. Dit Vis, Boec, veergadert ende gescreven van mij A. Coenen soen, geboren op de dorpe van Scheiveninghe Een visschers dorpe in de Noortsee leggende een cleijn mijlken van den vermaerden Hage in Hollant die is in veel landen wel bekend. Anno 1577 begonnen (—1578)*

Pre-Linn. 1577.1

This is a MS. work cited by Bosgoed from the Koninklijke Bibliotheek te 's Gravenhage (The Hague). It consists of 410 folios of colored figures.

Coetlegon, Denis de [—1749] *Universal history of arts and sciences.* London, 1745. fol.

Pre-Linn. 1745.1

Fishing, vol. I, p. 1007–12.

— *A tour through the animal world, or, an . . . account of near four hundred animals, birds, fishes . . . etc.* London, 1746. v, 173 p. 172 pls. 12°.

Pre-Linn. 1746.1

Cohausen, J. H., & Nuenning, J. H. See **Nuenning & Cohausen.**

Coker, N. *Survey of Dorsetshire, containing the natural history of that country.* London, 1732. 6 pls. map. fol.

Pre-Linn. 1732.1

Contains observations on fishes.

Colbiörnsen, Frid. (respond.) *Dissertatio de pisce, qui Jonam deglutivit.* Hafniæ, 1744. 4°.

Pre-Linn. 1744.1

Christ. Ræde, præses.

Cole, A., & Culpepper, Nich. See **Bartholinus, C.**, 1668.1.

Colerus, Johann. *Oeconomia ruralis et domestica*. Darin das gantz Amphaller treuer Haus-Vätter, Haus-Mütter begriffen. Auch Wild- und Vögelfang, Fischereyen, etc. 2 parts. Mäynts, 1656. 45 col. pls. 8°. Pre-Linn. 1656.1

Other eds.: Mainz, 1665, 1680. Frankfurt, 1672, 1686, 1692. 4°.

Colerus, —. *Calendarium perpetuum*. Wittenberg, 1627. Pre-Linn. 1627.1

Contains notes on Swiss fishes.

Collaert (also written Collard), Adrian [c. 1520–1567] *Piscium vivæ icones in æs incisæ et editæ ab Adriano Collardo*. Antwerp, c. 1580. 26 pls. 4°. Pre-Linn. 1580.1

"Ungewiss ist es, ob diese Stiche von einem älteren, um 1567 gestorbenen, oder von einem jüngeren Meister desselben Namens (welcher 1597 als Genosse der Malergilde des S. Lucas in Amsterdam erwähnt wird) herrühren." — Carus, J. V. *Geschichte der Zoologie*, p. 319. München, 1872.

— *Piscium vivæ icones inventæ ab Adriano Collardo, et excusæ a Nicolao Joannis Visscher, anno 1634*. Amstelodami, 1634. 20 pls. fol. Pre-Linn. 1634.1

This work is said to contain 25 plates of fishes, but the copy in the Stuart collection in the library of the A. M. N. H. has 19, plus an engraved title-page. In the same collection is a smaller volume in 4°, containing 8 plates and a title page without signature, date or place of publication, but bearing the words "*Piscium vivæ icones*." Careful comparison of these figures with the larger above shows beyond doubt that they were engraved by Collaert.

Collins, Samuel (Medicus) [1618–1710] *A systeme of anatomy treating of the body of man, beast, birds, fish, etc.* 2 vols. London, 1685. 74 pls. fol. Pre-Linn. 1685.1

Anatomy of 22 fishes given. The generative organs of a fish, vol. I, chap. xxxiv; description of the reproductive organs of a shark, p. 658 ff. pl.

Collinson, Peter [1694–1768] For a biographical sketch see Fothergill, J., "Some account of . . . P. Collinson, etc." London, 1770. 18 p. portr. 4°.

— Observations on the hardness of shells and on the food of the soalfish. *Phil. Trans. Roy. Soc. London*, 1744 (1746), 43, 37–39. Pre-Linn. 1746.1

— Observations on the Belluga stone. *Phil. Trans. Roy. Soc. London*, 1747 (1748), 44, 451. 2 pls. 6 figs. Pre-Linn. 1748.1

The "Belluga" here referred to is an *Acipenser* found in the Volga.

Colonna, Fabio. See **Columna, Fabius**.

Columella, Lucius Junius Moderatus [fl. 1st cent.] For a sketch of his life and writings, with notes and references, see Barberet, N. "*De Columellæ vita et scriptis*." Nantiaci, 1887. 128 p. 8°.

— *De re rustica libri xii* (In *Scriptores rei rusticæ*, Venice, 1472 fol.) Pre-Linn. 1472.1

The first edition of this collection which was many times republished, at least 20 editions having appeared before 1595.

The first separate edition of Columella's work seems to be:

— *De re rustica libri xii*, Bologna, 1494. Pre-Linn. 1494.1

Other early eds. are: 1514, 1520, 1529, 1533, 1535, 1541, etc. Early German versions: 1538 & 1612; the best is by M. C. Curtius. "*Zwölf Bücher von der Landwirtschaft*." Hamburg & Bremen, 1769. Italian translations: 1544, 1554, 1564. French versions: 1551 & 1556. In English we have:

— Of husbandry in twelve books, and his book concerning trees, translated into English . . . London, 1745. xiv, 600 p. 4°. Pre-Linn. 1745.1

Book viii, cap. 16, Concerning fishes and their food; cap. 17, concerning the locating of fish ponds.

An earlier edition: London, 1744.

Columella, L. J. M., Cato, M., & others. *Libri de re rustica*. Parisiis, 1533. 506 p. fol. Pre-Linn. 1533.1

Other eds.: Paris, 1543; Lugduni, 1549; Leipzig, 1794–95.

See also Cato, M., Varro, M. T., & others, Pre-Linn. 1533.1.

Columna, Fabius [1567–1650] For a sketch of his life, see that by J. Planus in item 1744.2 below.

— *Phytobasanos seu plantarum aliquot historia; accessit etiam piscium aliquot, plantarumque novarum historia*. Neapoli, 1592. xiv, 120, 32, 8 p. ill. 4°. Pre-Linn. 1592.1

Squatina & *Pastinaca* figured and described.

— *Minus cognitarum stirpium aliquot, ac etiam rariorum nostro coelo orientum, Ekphrasio . . . Item de aquatilibus, aliusque; animalibus quibusdam paucis libulellus . . . opus nunc primum in lucem editum*. Romæ, 1606. vi, 340, lxxiii, p. figs. 4°. Pre-Linn. 1606.1

Two rays described. Second notice of object called "*Glossopetra*" (shark's tooth). Other fossil fish remains in chap. xxi.

Another issue: Romæ, 1616. 4°.

— *Aquatilium et terrestrium aliquot animalium aliarumque naturalium rerum observationes.* Romæ, 1616.

Pre-Linn. 1616.1

— *De glossopetris dissertatio.* (In his *Tract. de purpura.* Romæ, 1616, 31 p. 4°.)

Pre-Linn. 1616.2

"Hac ostenditur Melitenses linguas serpentinae, sive glossopetras dictas, non esse lapideas, ut quidam asserunt, sed osseas & carchariae, laminae sive canicularum & similium dentes, maris aestu olim terra tenui & lutosa obrutos." — Gronow.

Other eds. are: Kiel, 1675, & Rome, 1678 & 1752.

— *Dissertatio de glossopetris* (In his *Historia stirpium rariorum.* 1744.)

Pre-Linn. 1744.1

This is also appended to A. Scilla's "*De corporibus marinis lapidiscantibus.*" Rome 1747, and in its other editions (1752, 1759).

— *Phytobasanos cui accessit vita Fabii et Lynceorum notitia adnotationesque in Phytobasanos J. Planci Ariminensi auctore. (Piscium aliquot . . . historia. J. Planci appendix ad vitam F. Columnæ)* Florentiæ, 1744. lii, 134, 2 p. 38 pls. 4°.

Pre-Linn. 1744.2

Comenius, John Amos [1592–1670] *Janua linguarum.* Lesna, 1631.

Pre-Linn. 1631.1

Westwood and Satchell remark of this work that it "is a sort of encyclopædic phrase-book, each of the 100 chapters containing the words used in a separate art, science or trade, and explaining them by means of the context." It contains a description of the art of fishing.

English editions are:

— The gate of tongues unlocked and opened, or else a seminary or seed-plot of all tongues and sciences. London, 1639.

Pre-Linn. 1639.1

In Latin, English and French.

— *Latinae linguae janua reserata.* The gate of the Latine tongue uulocked. London, 1650. 8°.

Pre-Linn. 1650.1

Other eds.: London 1658 & 1670; all in Latin, English, & French.

Commelin, Caspar [1667–1731] *Observationum anatomicarum collegii privati Amstelodamensis.* 2 vols. Amstelodami, 1667–1673. pls. 12°.

Pre-Linn. 1667.1

In the first part, the anatomy of the carp and pike is given; in the second, there are figures and descriptions of the pancreas of various fishes.

Conny, Robert [c. 1645–1713] Letter concerning a shower of fish. *Phil. Trans. Roy. Soc. London*, 1698, 20, 289–290.

Pre-Linn. 1698.1

Conrad von Megenberg. See **Konrad von Megenberg.**

Conringius, Hermannus [1606–1681] *J. Dubravii . . . De piscinis libri v . . . Omnia H. Conringii cura iterum edita & . . . purgata, cum præfationibus.* 1671. 4°.

Pre-Linn. 1671.1

See also Dubravius, J. (this section).

"In 1657 H. Conringius collected the treatises of several old writers on fish-ponds and fish and fishing, and printed them at Helmstadt in a quarto volume without collective title-page but with continuous register. By the collector, who reads as well as gathers, this book will be highly prized. It contains the treatise of Dubravius 'de piscinis'; portions of Varro's third book; chapters LIV–LVI of Pliny's ninth book; book twenty of the 'Geoponika' of Cassianus Bassus; excerpts from Crescentius and Heresbachius concerning fish-ponds, and the book on fishing from the latter's 'Thereutices.'" — Westwood & Satchell.

Cooke, Edward. *A voyage to the South Sea, and round the world, perform'd in the years 1708, 1709, 1710, and 1711.* 2 vols. London, 1712. vol. I, 456 p.; vol. II, 318 p.

Pre-Linn. 1712.1

Vol. I. Fishes on coast of Brazil. p. 27. pl.; fishes of Chile, p. 66; Juan Fernandez, p. 115. pl.; Lobos Is. (sun fish), pp. 120, 123, 128. pl. Thrashers and sword fishes kill whales, pp. 173 & 317. Fishes of Peru, p. 210; Galapagos Is., p. 317. pl.; Tres Marias, p. 329; Lower California, pp. 340–344. 2 pls.

Coppier, Guillaume. *Histoire et voyage des Indes Occidentales, etc.* Lyon, 1645. 184 p.

Pre-Linn. 1645.1

Des poissons marins, p. 94–115. Copy, A. M. N. H.

Coppini, Carlo Franc. *Prigioni, e morte delli pesci, raccolte de diversi eccellenti authori.* Dal Signor Dottore C. F. C. Roma, 1655. viii, 234, xxvi p. 8°.

Pre-Linn. 1655.1

Cornelius, Georgius. *Piscatio philosophica excellentiæ Ill^{me} ac Reverendissime D. D. Georgii Cornelii Ecclesie Patavine Episcopi dicata* (1662). 43 pls. 12°.

Pre-Linn. 1662.1

Has 19 plates of fishing scenes.

Corvinus, Georgius Ludovicus. *Dissertatio botanico-medica inauguralis de Scilla, &c.* Altorfi, 1715. 4°.

Pre-Linn. 1715.1

A shrimp which is destructive to fishes.

Cotton, Charles [1630–1687] *The compleat angler.* Being instructions how to angle for a trout or grayling in a clear stream. London, 1676. 112 p. 12°.

Pre-Linn. 1676.1

This is part II of the second impression of the 5th edition of Walton's "*Compleat Angler*," 1676; the full title of which reads as follows:

Cotton, C.

The universal angler, made so, by three books of fishing. The first by Mr. Izaak Walton; the second by Charles Cotton Esq.; the third by Col. Robert Venables. All which may be bound together, or sold each of them severally. London, 1676. 8°.

Cotton's section of this was sold separately or conjointly with Walton and Venables. From this time on, the work was known as Walton & Cotton's "Compleat angler." For further information as to editions, see Walton, Izaak (this section). For post-Linnæan editions, see Walton, I., 1759.1, and Walton, I. & Cotton, C., 1893.1.

Cotton, Charles, & Walton, Izaak. See Walton & Cotton.

Cousin, Jo., & Le Vasseur, Claud. Ergo pisces carnibus salubriores. Paris, 1637. Pre-Linn. 1637.1

2nd ed.: Paris, 1661.

Cox, Nicholas. The gentleman's recreation, in four parts; (*viz.*) hunting, hawking, fowling, fishing. Collected from ancient and modern authors foreign and domestick, and rectified by the experience of the most skilfull artists of these times. London, 1674. x, 284 p. 4 pls. 8°. Pre-Linn. 1674.1

"In this edition the book is not claimed by Nicholas Cox, whose name is appended to the 'Epistle Dedicatory,' in the second and subsequent issues." W. & S.

Cox's book was reviewed in Phil. Trans. Roy. Soc., 1675, 10, 461-466. Other eds. are: 1677, 1685, 1686, 1697, 1706, 1721, 1731.

Copy 1677 ed., N. Y. P.

This is most accessible to the modern reader in the following form:

The nobleman and gentleman's recreation; *viz.* The fowler. The falconer. The fisherman. The huntsman. London, (1815?). 8°.

This was again republished — subsequent to 1836.

Coyett, Balthazar. Poissons écrevisses et crabes . . . que l'on trouve autour des îles Moluques, et sur les côtes des terres australes: . . . Ouvrage . . . copié sur les originaux de M. B. Coyett, etc. Tome I. Amsterdam, 1718-1719. fol. Pre-Linn. 1718.1

See note under Renard, L., this section.

Cramer, Abia Georg (respond.) Dissertatio de pisce Torpedine ejusque proprietatibus admirandis exhibens. Inaug. Dissert. Kiloni, 1710.

Pre-Linn. 1710.1

Johann Ludwig Hannemann, *præses*.

Crescentiis, or Crescenze, Pietro de [1230-1310] For a life of this author, see that in the modern edition of his works in footnote below.

— *Ruralium commodorum libri duodecim finiunt feliciter.* Augustinum [Augsburg], 1471. 209 unpagged leaves. Pre-Linn. 1471.1

The first edition (black letter) of a work supposed to have been written early in the 14th century. It has been frequently reprinted and translated. John of Westphalia printed three editions at Louvain, one in 1473.

Versions in various languages follow.

— *Il libro della agricultura. Florentiæ, 1478.* Pre-Linn. 1478.1

The earliest Italian version, which was reprinted at Vicenza, 1490, and several times at Venice.

— *Le liure des prouffits champpestres et ruraulx.* Paris, 1486. fol. Pre-Linn. 1486.1

The first of many French versions, another being "Le bon manager," Paris, 1533. fol.

— *Trattato dell' agricultura vulgarizzato, etc.* Venice, 1511. Pre-Linn. 1511.1

The 1st Italian version issued at Venice. Others are: 1519, 1534 ("Opera di Agricultura"), 1536, 1561 & 1605. A German version was published at Strassburg, 1493, and was many times reissued.

— *De omnibus agriculturæ partibus & de plantarum animaliumque, etc.* Basel, 1548. xii, 385 p. figs. Pre-Linn. 1548.1

An earlier Latin ed.: Paris & Strassburg, 1486.

A modern edition, to which is appended a sketch of Crescentiis and an estimate of his work, is: "Trattato della agricultura . . . ; Translato nella fevella Fiorentina revisto dallo Uferigno [B. de' Rossi] (Vita di P. Crescenzi — Osservazione sopra lo scritto di P. Crescenzi) 3 vols. Milano, 1805."

Crescenze indicates the various methods of rendering ponds and inland lakes profitable. He is one of the "old farmers" discussed by Donald G. Mitchell in his "Wet days at Edgewood." (See Mitchell, D. G., 1865.1)

Copies of 14th cent. eds. of the above work in H., N. Y. S., & A. P. S.

Crescentio, Bartholomeo. Nautica Mediterranea. Roma, 1607. fol. Pre-Linn. 1607.1

Remora as a ship-detainer. pp. 397-398.

Crescenze, Pietro de. See **Crescentiis, Pietro de.**

Cube or Cuba or Caub, Johann von. For an analysis of the "Hortus" and a critical study of its authorship, see Choulant, Ludwig. "Graphische Incunabeln für Naturgeschichte und Medicin . . . des XV und XVI Jahrhunderts." Leipzig, 1858, pp. 20-75. Choulant calls the "Hortus," "das wichtigste Naturhistorie des Mittelalters mit Abbildungen." See also Payne, J. F. "On the Herbarius and Hortus Sanitatis." Trans. Bibliog. Soc. London, 1901, 6, 70 p. illust. 4°. (Payne argues that Cube was not the author of the "Hortus")

For further bibliographical details as to titles, dates and places of publication, see Klebs, —. "Incunabula Lists, Herbals (The Hortus Sanitatis family)." *Papers Bibliog. Soc. Amer.*, 1917 & 1819. vols. XI-XII. See also Everard, H. 1898.1

According to Choulant, Cube's work appeared in two forms which he designates as "Des Kleineren" and "Des grösseren Hortus sanitatis." The first edition of the smaller bears title as follows:

— Hortus sanitatis auff teutsch ein gart der gesundheit. Mainz, 1485. 359 leaves. 389 figs.

Pre-Linn. 1485.1

This edition appeared in March, 1485. Other eds. are: Augsburg (August) 1485, 1486, 1487, 1488, 1493, 1496, 1499; Ulm, 1487.

Four other eds. without place or date are listed by Choulant. All the above, or "Kleineren," eds. are in German and some bear the title "Herbarius zu teutsch," etc.

The "grösseren" Hortus was first published in Latin as follows:

— Ortus sanitatis. Mainz, 1491. 453 leaves. woodcuts. fol.

Pre-Linn. 1491.1

Six other folio eds. appeared in Latin as follows: Venice, 1511; Strassburg, 1536; and four without place or date.

Choulant notes eight German eds. as follows: Strassburg, 1507, 1515, 1521, 1527, 1529, 1536; Augsburg, 1508; & Frankfort, 1533. Low Saxon eds. appeared at Lübeck in 1492, 1510, and 1520. Dutch eds. are: Antwerp 1511, 1514, 1547; Brussels, 1514, & Utrecht, 1538. Paris issued two eds., one in 1539 and one without date.

A different French version bearing the title "Arbolaire," "Herbolaire," or "Le Grant Herbier," ran through six editions.

Haller in his "Bibliotheca Botanica," vol. I, pp. 240-242, lists many other editions seemingly not known to Choulant. The following title is for a good later edition:

— Hortus sanitatis, quatuor libris haec quæ subsequuntur, complectens. De herbis et plantis, de animalibus et reptilibus, de avibus et

volatilibus, de piscibus et natatilibus, etc. Argentorati, 1517. figs. fol. .

Pre-Linn. 1517.1

The "Hortus" is divided into many short chapters, each (for the most part) with its illustrative woodcut. The edition of 1491 (possibly the best) devotes 106 chapters to fishes. The "Hortus" contains the first known figure of Remora acting as a ship-retarder.

Copies of various early eds. are in H., Y., A. M. N. H., Pa., L. C., & J. C.

The author or compiler of the "Hortus Sanitatis" has been identified as Dr. Johann Wonneken von Cube, town physician of Frankfort, toward the end of the 15th century.

This remarkable work seems not improbably to have been based in large part on the "Herbarius Moguntinus" which first appeared from the press of Schäffer at Mainz, in 1484, and which enjoyed great popularity as the 16 later editions testify. In any case, it was a compilation of all medical data known at the time of its publication.

Culpepper, Nich., & Cole, A. See Bartholinus, C. 1668.1.

Cupani, Francesco [1657-1711] Panphyton siculum, sive historia naturalis de animalibus, stirpibus et fossilibus, quæ in Sicilia vel in circuitu ejus invenientur. Opus posthumum, etc. Panormi (Palermo), 1713. 168 pls. fol.

Pre-Linn. 1713.1

For a commentary on this work, see Riggio, G. "Corrispondenze scientifiche degli [animali] [pesci] figurati nel Panphyton siculum del Cupani." *Nat. Sicil.*, 1882, 11, 160-163.

Curzon, H. The universal library: or complete summary of science. Containing above sixty select treatises. 2 vols. London, 1712. 8°.

Pre-Linn. 1712.1

Angling, vol. II, p. 458-467.

Cysat, Johann Leopold. Beschreibung des berühmten Lucerner oder Vier-Waldstaetten-Sees . . . Darinnen gemeldet wirdt . . . des Sees Länge, Breite, Tieffe, und wie mancherley herrlicher guter Fisch in dem selben zu finden . . . etc. Lucerne, 1661. x, 256 p. 4°.

Pre-Linn. 1661.1

Fische, p. 20-101.

D

D, L. B. *Traité des étangs, des viviers, fosses, etc.* Paris, 1717. 12°. Pre-Linn. 1717.1

Dale, Samuel [c. 1659–1739] *Pharmacologia, seu manductio ad materiam medicam, in qua medicamenta officinalia simplicia, hoc est . . . animalia, eorumque partes in medicinæ officinis usitata, in methodum naturalem digesta succincte & accurate describuntur.* Londini, 1693. 12°. Pre-Linn. 1693.1

Contains system of classification of fishes.
Other eds.: London, 1710 & 1737; Bremen, 1713; Leyden, 1739.

— An account of a very large eel lately caught at Malden in Essex, with some considerations about the generation of eels. *Phil. Trans. Roy. Soc.* London, 1698 (1699), 20, no. 238, 90–97. Pre-Linn. 1699.1

— The natural history of the sea coast and country about Harwich. London, 1730. 4°. Pre-Linn. 1730.1

First published as above, then included in:

— The natural history of the sea coast and country around Harwich (In Taylor, Silas. *The history and antiquities of Harwich and Dovercourt in the county of Essex.* London, 1732. 4°.) Pre-Linn. 1732.1

Another ed.: London, 1742.

Dampier, William [1652–1715] For sketches of his life. see Smyth in *United Service Journ.*, 1837, pts. II & III; & Laughton in *Dict. Nat. Biog.*, and Masefield in citation below.

— A new voyage round the world, etc. London, 1697. vi, 550 p. 5 maps. 8°. Pre-Linn. 1697.1

Other eds.: London, 1697 (2nd), 1698, 1699, 1703, 1717, 1729 (best); Amsterdam in French, 1698 (2 eds.), 1701, 1705–12, 1711, 1717, 1723; Paris, 1701–05; Rouen, 1715, 1723 (2 eds.); in Dutch, The Hague, 1700; Amsterdam, 1698, 1716–17; Nymegen, 1771–72; in German, Leipzig, 1702, & Colle, 1783.

— Voyages and descriptions, in three parts, viz.: I. A supplement to the voyage round the world, etc.; II. Two voyages to Campeachy, etc.;

III. A discourse of trade-winds, etc. London, 1699. 184, 132, 112 p. 8°. Pre-Linn. 1699.1

Other eds.: London, 1700, 1705, 1729; I (above), French ed., Amsterdam, 1711. French ed. of III, Amsterdam, 1701.

— A voyage to New Holland, &c. in the year 1699, etc. London, 1703. 162 p. 8°. Pre-Linn. 1703.1

Other eds.: London, 1609, 1729.

— A continuation of the voyage to New Holland, etc. in the year 1699, etc. London, 1709. 198 p. 8°. Pre-Linn. 1709.1

Both "Voyages to New Holland," in French, Amsterdam, 1711.

Dampier's collected "Voyages" were first published in a "Collection of Voyages" along with those of Wafer, Funnell, and others, London, 1729. They were published separately as "Voyages and Adventures" in 2 vols. London, 1777. 8°; and as "Voyages and Discoveries," 2 vols. London, 1790. 12°. They are best available to the present day reader in Masefield's fine reprint, published by Richards, London, 1906. See Dampier, W., 1906.1

"As is well known, Dampier was an acute natural history observer as well as a bold navigator and adventurer, and his observations on the beasts, birds, and fishes he met with during his long voyages are among the best and most trustworthy of his time." — J. A. Allen (*Bibl. of Cetacea and Sirenia*, 1882. p. 430).

Dapper, Olfert [—1690] *Beschrijving des Keizerrijks van Taising of Sina; versiert met verscheyde koopere plaeten.* Amsterdam, 1670. fol. Pre-Linn. 1670.1

Title from Bosgoed. Brit. Mus. (Nat. Hist.) gives the following title:

— Gedenkwaardig Bedryf der Nederlandsche Oost-Indische Maetschappye, op de Kuste in het Keizerrijk van Taising of Sina, etc. Amsterdam, 1670. (in parts.) ills. 4°. Pre-Linn. 1670.2

— Atlas Chinensis, being a relation of remarkable passages in two embassies from the East India Company of the United Provinces to the Vice-Roy Singlamong, etc. London, 1671. fol. Pre-Linn. 1671.1

Other eds.: Amsterdam, 1672 (Dutch); 1673–1676 (4 German eds.); London, 1673 (English version).

Numerous notes on fish and fishing.

— *Arca temporum reserata sive der Welt eröffnete Zeit- und Geschichtsbeschreibung: (ubi tertio loco Trinum marinum, sive die drei an einander hangende Meere, Pontus Euxinus, Propontis, cum Archipelago, mit ihren umliegenden Seen, Flüssen, Thieren, Vögeln, Fischen und Raritäten vorgestellt durch Philonem Chronographum. Augspurg, 1693. fol. Pre-Linn. 1693.1*

Davies, John (of Kidwelly) (translator). See **Rocheport, C. de**. 1666.1.

Debes, Lucas Jacobson. *Feröernes beskrivelse*. Kiöbenhavn, 1673, pls. map. 8°. Pre-Linn. 1673.1

Translated as follows:

— *Færøe, & Færoa reserata; that is, a description of the islands & inhabitants of Færøe . . . Wherein several secrets of nature are brought to light, etc. Englished by J[ohn] S[terpin]. London, 1676. xii, 408 p. 8°. Pre-Linn. 1676.1*

Reviewed in *Phil. Trans. Roy. Soc.* 1675, 10, 456-460.

Fishes on p. 460.

— *Natürliche und politische Historie der Inseln Farøe, worinn die Luft, Grund und Boden, Gewässer, Thiere, Vögel, Fische, etc., das Naturel, die Gewohnheiten, Lebensart der Einwohner dieser Inseln und ihre Verfassung beschrieben werden. Kopenhagen & Leipzig, 1757. pl. 8°. Pre-Linn. 1757.1*

De Laet, Jean. See **Laet, Joannes de**.

De l'Escluse, Charles. See **Clusius, Carolus**.

Delius, Heinrich Friedrich [1720-1791] *Von der kalten Electricität des Zitterfisches*. Erl. Gel. Anmerk., 1752, no. 50. Pre-Linn. 1752.1

Denison, Alfred (Editor). See **Boeckken**, under Anonymous titles.

Dennys, John [-1609] For critical remarks on the man and his book, see **Marston, R. B.**, 1894.1. For further notes, see also **Westwood & Satchell**, 1883.1. The book is extensively noticed with considerable citations in an article in "*Censura Litteraria*," 1809, 10, p. 266.

— The secrets of angling; teaching the choisest tooles, baytes and sea-

sons, for the taking of any fish, in pond or river: practised and familiarly opened in three bookes. By J. D.[ennys] Esquire. London, 1613. 30 leaves. 8°. Pre-Linn. 1613.1

— The secrets of angling: . . . Augmented with many approved experiments. By W. Lauson. London, 1620. 35 leaves. 8°. Pre-Linn. 1620.1

Other issues of Lauson's augmented ed.: London, 1630 & 1652.

This work is most accessible to the modern reader in the following forms:

"The secrets of angling." Reprinted in **Edward Arber's "An English Garner."** 1877, vol. I, pp. 141-198; and as reprinted eds.: London, 1811, 1883, & Edinburgh, 1885.

Denso, Johann Daniel [1708-1795] *Neue bestätigte Erfahrung vom Gehöre der Fische*. (In his *Physikalische Bibliothek*. Rostock, 1756, 2, 188.) Pre-Linn. 1756.1

Various other articles on fish are contained in this volume.

Denton, Daniel [fl. 1670] A brief description of New York, formerly called New Netherlands. London, 1670. 21 p. 8°. Pre-Linn. 1670.1

The rivers of Long Island are said to be "very well furnished with fish, as basse, sheeps-heads, place, pearch, trouts, eels, turtles and divers others." This is the first printed reference to Long Island fishes.

Denys, Nicolas. *Description géographique des côtes de l'Amérique septentrionale, avec l'histoire naturelle du pays*. 2 vols. Paris, 1672. 12°. Pre-Linn. 1672.1

Some notes on the cod fishery.
A German version is:

— *Summarische Nachricht von dem Bakkeljau- und Stockfisch-Fang bei Terreneuf, in den nordlichen Theilen von America, aus den Schrifften des Herrn Denys gezogen*. (In **Zordrager, C. G.** *C. G. Zordrager's alte und neue Grönlandische Fischerei und Wallfischfang, &c.* Leipzig, 1723. 4°.) Pre-Linn. 1723.1

Derham, William [1657-1735] *Physico-theology or a demonstration of the being and the attributes of God from the works of creation*. London, 1713. 8°. Pre-Linn. 1713.1

Swim-bladder and eyes of fishes considered.

This is the 1st ed. of a book which became immensely popular and ran through many editions. At least 7 were issued at London, 1713-1798, and 2 at Glasgow. Of versions in foreign languages there are: 5 French; 3 German; 2 Dutch; 2 Danish; 1 Swedish, and 1 Italian, before the year 1800. Two have been found.

Derham, W.

— Dimostrazione della essenza ed attributi d'Iddio dall' opere della sua creazione; tradotta dall' Inglese. Firenze, 1719. 4°. Pre-Linn. 1719.1

— Physico-theologie, eller til Gud ledande naturkunnighet, öfversatt af A. N. Stockholm, 1736. 606 p. pl. 8°. Pre-Linn. 1736.1

Deslandes, A. F. Sur la génération des soles et des chevrettes. Mém. Acad. Sci. Paris, 1722 (1724), hist., 19–20. Pre-Linn. 1724.1

Eggs of sole attached to shrimps.

— Observations sur les maqueraux et les sardines, poissons très communs en Bretagne, etc. Mém. Acad. Sci. Paris, 1725 (1727), hist., 2–3. Pre-Linn. 1727.1

— The production of sole fish [from shrimps] Gentleman's Mag. Hist. Chron. [Urban's], 1753, 23, 575–576. Pre-Linn. 1753.1

Eggs of sole attached to shrimps.

— Recueil de differens traitez de physique et d'histoire naturelle propres à perfectionner ces deux sciences. 3 vols. Paris & Bruxelles, 1736. illust. 8°. Pre-Linn. 1736.1

Lettre sur la pêche des saumons, etc. Vol. I, p. 161–196.

Other eds.: Paris, 1748, 1753, 1764; Brussels, 1736, 1753; Amsterdam, 1737.

Dezallier d'Argenville, Ant. Jos. See **Argenville, Ant. Jos. Dezallier d'.**

Dioscorides, Pedianus or *Pediacus Anazarbanus* [fl. 1st or 2nd cent. A. D.] De materia medica. Colle, 1478. Pre-Linn. 1478.1

In book II are noted 5 or 6 fishes from the standpoint of use in medicine or as food.

First edition of a work which passed through a multitude of reissues, 57 being listed by Boehmer, who says that Dioscorides has also had scores of commentators.

A modern ed. of the works of Dioscorides was published at Leyden, 1906.

Copies: 1st ed., L. C.; 1499 ed. Opera (premier ed. in Greek), N. W. & Surg.

Dodd, James Solas [1721–1805] An essay towards a natural history of the herring. London, 1752. viii, 178, 11 p. pl. 8°. Pre-Linn. 1752.1

Döbel, Heinrich Wilhelm. Von einer Forelle mit Characteribus und Buchstaben. Bressl. Natur u. Kunstgeschichte, 1718, 3. Vers., 689. Pre-Linn. 1718.1

— Jäger-Practica oder der wohlgeübte und erfahrene Jäger. [n. p.] 1746. Pre-Linn. 1746.1

Thirty-four fishes referred to. Reproduction in eel. New ed., Neudamm, 1912. Concerning this work, see Eberts, "[Discussion of] Heinrich Wilhelm Doebels Jäger-Practica. 1746." Allgem. Fischerei-Zeitg., 1913, 38. Jahrg., 118–120.

Donati, Antonio [1606–163–] Trattato dei semplici pietre et pesci marini, che nascono nel lito di Venetia, la maggior parte non conosciuti da Teofrasto, Dioscoride, Plinio, Galeno ed altri scrittori, diviso in duo libri. Venezia, 1631. 120 p. 31 pls. 4°. Pre-Linn. 1631.1

Donck, Adrian van der. Vertoogh van Nieu-Neder-Land, weghens de gheleghentheydt vruchtbaerheydt, en sobaren staet desselfs. s'Gravenhage, 1650. Pre-Linn. 1650.1

— A description of the New Netherlands, as the same are at the present time, etc. 2nd. ed. Amsterdam, 1656. Pre-Linn. 1656.1

Reprinted in Coll. N. Y. Hist. Soc., 1841, 2. ser. 1.

"Of the fishes," p. 175.

Dos Santos (Friar), João [—1622] Ethiopia oriental. 2 pts. (in 1 vol.) Evora, 1609. 546 p. Pre-Linn. 1609.1

This was reprinted in Pinkerton's Voyages, 1814, vol. XVI, and in a late Portuguese ed., Lisbon, 1891. More available is the modern Portuguese and English ed.:

Ethiopia oriental (In Theal, G. Mc. C. Records of southeastern Africa, etc. London, 1901, vol. VII.)

Fishes of Sofala (Tremedor=*Malapterurus*?), p. 243–244. Fishes of Cuama, p. 260. Sword-fish fighting whale, p. 323. Fishing with remora, p. 326–327. Sharks of Mozambique, p. 328–330.

Drayton, Michael [1563–1631] For a biography, see Elton, Oliver. "Michael Drayton." 1906.

— Polyolbion, or a chorographical description of all the tracts, rivers, mountains . . . of Great Britain. 1613–22. Pre-Linn. 1613.1

In this poem are many allusions to fish and fishing. Westwood and Satchell intimate that it may have served as an antetype of Walton's "Compleat Angler."

The "Polyolbion" is also found in Drayton's works published in 1748 in folio, and again in 4 vols. 1753. 8°.

For notes on the fishes mentioned by Drayton, see Carr, J. W., 1898.1.

Du Bartas, (Seigneur) Guillaume de Saluste [1544–1590] For a sketch of his life and a résumé of his works, see Pelissier, G. "La vie et les oeuvres de du Bartas." 1883.

— Divine weekes & workes; translated by Josuah Sylvester. London,

1608. (24), 544, 193, (23) p. pls. portr. sm. 8°. Pre-Linn. 1608.1

The fifth day of the "Divine weekes and workes" records the creation of sea and river fish.

Other editions of Sylvester's translation are: 1598 (1st ed.), 1605, 1608, 1611 (English and French versions), 1613, 1621, 1633. Each part was printed with a separate title page and dedication and the parts were often reprinted — at least 16 being recorded.

A French version of Du Bartas' complete works is:

— Les oeuvres de G. De Saluste Sr. Du Bartas. Reveües corrigees. Augmentees de nouveaux. Commentaires annotations en marge et embellie de figures sur tous les jours de la semaine. . . . Dernier edition. 2 parts. Paris, 1611. 457 & 534 p. fol.

Pre-Linn. 1611.1

Most available today in reprint in Sylvester, Joshua. "Complete works," edited by A. B. Grosart. 1880. 4°.

Du Bartas wrote his great poem (in French) on the divine weeks and works, beginning with the creation and extending to the beginning of the Christian era. The first section was published in 1578; the second in 1584. Data are not at hand for the others. This work sprang into instant popularity and ran through 30 editions in 6 years. The title of the first French edition is not at hand. Many translations of the whole and of its parts were made in English (see Lowndes, vol. I, p. 679). Probably the best is that listed above.

Dubravius or Dubraw, Janus or Johannes (Bishop of Olmütz) [— 1553] Johannes Dubravius Buch von den Teichen und den Fischen etc. in 5 Büchlein. Breslau, 1547.

Pre-Linn. 1547.1

— De piscinis et piscium qui in eis aluntur naturis libri quinque. Moraviae Prostanna, 1552. 12°.

Pre-Linn. 1552.1

These are the 1st & 2nd eds. Others: Zurich, 1559; Leyden, 1596; Nuremberg, 1596, 1623; Helmstadt, 1600 & 1671 (See Conringius, H., in this section); London, 1599 (English). This last is entitled:

— Newe booke of good husbandry, very pleasant and of great profite both for gentlemen and yeomen, conteining the order and manner of making fish pondes, with the breeding, preserving and multiplyinge of the carpe, tench, pike and troute, and also divers kinds of other fresh fish; translated from the Latine. London, 1599. iv, 74 p. pl. 4°.

Pre-Linn. 1599.1

A modern version in German was issued [Vienna?] under the editorship of Wüstner & Kollmann in 1906.

Copy, 1559 ed. in A. M. N. H.

Duchesne, Légier. See **Quercu, Leodegarius à** (pseud.).

Dudley, Paul. The decreased size of smelt living in a pond to which they had been transplanted, from the Thames river sixty years previously. Phil. Trans. Roy. Soc. London, 1722 (1724), 32, 231–232. Pre-Linn. 1724.1

Du Halde, J. B. [1674–1743] Description géographique, historique, chronologique, politique et physique de l'empire de la Chine, et de la Tartarie chinoise, enrichie de cartes et d'un grand nombre de figures. 4 vols. La Haye, 1736. 4°. Pre-Linn. 1736.1

Fishes; vol. I, p. 42, 43, 191, 210; vol. II, p. 165–166. Methods of fishing; vol. II, p. 168; vol. IV, p. 202.

The 2nd ed. The 1st, 4 vols., Paris, 1735. illust. An English version is:

— The general history of China . . . done from the French of P. Du Halde (by R. Brookes). 4 vols. London, 1736. ill. 8°.

Pre-Linn. 1736.2

A somewhat abridged German version in 4 vols. was issued Rostock, 1747.

Dupetit, François Pourfour [1664–1741] Mémoire sur plusieurs découvertes faites dans les yeux de l'homme, des animaux à quatre pieds, des oiseaux et des poissons. Mém. Acad. Roy. Sci. Paris, 1726 (1728), 69–83.

Pre-Linn. 1728.1

— Mémoire sur le cristallin de l'œil de l'homme, des animaux à quatre pieds, des oiseaux et des poissons. Mém. Acad. Sci. Paris, 1728 (1730), 4–64.

Pre-Linn. 1730.1

— Histoire de la carpe. Mém. Acad. Sci. Paris, 1733, 197–222. 7 pls. — Comm. Litt., Noriberg, 1739, 212–238.

Pre-Linn. 1733.1

Durante, Castore [1529–1590] Herbario nuovo . . . con figure, che rappresentano le vive Piante, che nascono in tutta Europe, & nell' Indie Orientali, & Occidentali. Con versi Latini, che comprendono le facoltà de i semplici medicamenti. Con discorsi, che dimostrano i nomi, le spetie, la forma . . . dell' herbi, &c. Roma, 1585. xxiv, 492, 43 p. illust. fol. Pre-Linn. 1585.1

Other (Latin?) eds.; Venetia, 1602, 1636, 1667.

— Il tesoro della sanita . . . nel quale s'ensigna il modo di conservar la sanita, & prolungar la vita, et si tratta della natura de' cibi, & de' remedii de' nocumenti laro. (n. p.) 1593.

Pre-Linn. 1593.1

Durante, C.

The N. Y. P. L. has an edition of identical title issued, Venice, 1623, on pp. 269-300 of which various fishes are named and their use considered as food and in medicine.

There are other (Italian?) editions of 1605, 1663, 1668, 1686, & 1696.

— Hortulus sanitatis, das ist ein heylsam und nützliches Gährtlein der Gesundheit. In . . . Teutsche . . . versetzt [mit einen Vorwort] durch P. Uffenbachium. Franckfort, 1609. xvi, 1081, (50) p. illust. 4°.

Pre-Linn. 1609.1

A German version of the "Herbario."

— Theatrum plantarum, animalium, piscium et petrarum. Venetiæ, 1636.

Pre-Linn. 1636.1

Another ed.: 1656.

Duret, Claude [-1611] Histoire admirable des plantes et herbes esmerveillables et miraculeuses en nature: mesmes d'aucunes qui sont vrayes zoophytes, &c. 1605. illust. 8°.

Pre-Linn. 1605.1

Contains some illustrations of trees producing fish.

Du Tertre, Jean Baptiste [1610-1681] Histoire générale des isles de Christophe, de la Guadeloupe, de la Martinique et autres dans l'Amérique, etc. Paris, 1654. viii, 481 p. pls. 3 maps. 8°.

Pre-Linn. 1654.1

Partie iv, traité 1. Des poissons.
Enlarged and republished as:

— Histoire générale des Antilles habitées par les François; contenant l'histoire naturelle, enrichy de cartes & de figures. Par le R. P. [Jean Baptiste] du Tertre, de l'ordre FF. Prescheurs, de la Congregation de S. Louis, missionnaire apostolique dans les Antilles. 3 vols. Paris, 1667-1671. 8°.

Pre-Linn. 1667.1

Tome II, traité 4. Des poissons. Chap. 1. Des poissons de la mer.

Duval de la Lissandrière, P. Ne'el. Traité universel des eaux et forêts de France, pesches et chasses, etc. Paris, 1699. viii, 515, xxvii p. 8°.

Pre-Linn. 1699.1

A treatise on the laws controlling fishing and hunting in France.

Duverney, Joseph Guichard [1648-1730] Mémoire sur la circulation du sang des poissons qui ont des ouïes et sur leur respiration. Mém. Acad. Sci. Paris, 1701 (1729), (hist. 46-50), 226-241.

Pre-Linn. 1729.1

Also contained in "Oeuvres anatomiques," T. II, p. 496-510, of the same author, and in Walbaum, J. J. "Petri Artedi Renovati. Pars. II. Philosophia Ichthyologica." Grypeswaldiæ, 1789, appendix, p. 167-183.

— Observations sur la circulation du sang dans le fœtus; et description du coeur de la tortue et de quelques autres animaux. Mém. Acad. Sci. Paris, 1699 (1732), 227-274. pls.

Pre-Linn. 1732.1

Heart of carp, pp. 240-245. 2 pls. This section has been reproduced under the following title:

"Observation sur la structure du coeur des poissons." (In Walbaum, J. J. "Petri Artedi Renovati. Pars. II. Philosophia Ichthyologica." Grypeswaldiæ, 1789, appendix, p. 156-167)

— Observations sur les ouïes des poissons. Mém. Acad. Sci. Paris, 1666-99 (1733), 1, 280-281.

Pre-Linn. 1733.1

— Observation sur les poissons femelles. Mém. Acad. Sci. Paris, 1686-1693 (1733), 2, 122.

Pre-Linn. 1733.2

Du Villard, Jean. Description de dix-neuf sortes de poissons qui se trouvent dans le Rhône et le lac de Genève. Genève, 1581.

Pre-Linn. 1581.1

E

Eames, John [-1744] An account . . . of a book intituled, Jacobi Theodori Klein "Historiæ Piscium Naturalis promovendæ missus primus Gedani," 1740. 4°. Or the first number of an essay toward promoting the natural history of fishes, etc. Phil. Trans. Roy. Soc., 1742, 42, 27-33.

Pre-Linn. 1742.1

Eber, Paul., & Peucer, Casp. Vocabula rei numariæ ponderum et mensurarum graeca, latina, ebraica etc. Additæ sunt appellationes quadrupedum, insectorum, volucrum, piscium, frugum, leguminum, olerum et fructuum communium. Vitebergae, 1551. 16°.

Pre-Linn. 1551.1

Other eds.: Wittenberg, 1556, 1558, 1563, 1570, 1574, 1578; & Leipsic, 1559, 1570. See also Peucer, C. Pre-Linn. 1550.1.

Eccard, — (*respond.*) Dissertatio de respiratione piscium. Witteb., 1637. 2 pls. 4°.

Pre-Linn. 1637.1

Jo. Sperling, *præses*.

Eden, Rycharde [1521-1576] The decades of the newe worlde or west India, etc. Wrytten in the Latin tounge by Peter Martyr of Angleria, and translated into Englyshe by Rycharde Eden. Londini, 1555.

Pre-Linn. 1555.1

Contains numerous references to the fishes of the new world, and the first account in English of fishing with the remora.

This work is available in Arber, Edward. "The first three English books on America [1511-1555 A.D.], being chiefly translations, compilations, &c., by Richard Eden." London, 1895. See also Martyr, P., this section.

Copy of original edition, J. C. B.

— The history of travayle in the West and East Indies, and other countreys lying eyther way towards the fruitfull and ryche Moluccaes: with a discourse of the northwest passage. Gathered in parte, and done into Englyshe by Richarde Eden. Newly set in order, augmented and finished by Richarde Willes. London, 1577. 4°.

Pre-Linn. 1577.1

A compilation of Peter Martyr, Oviedo, and other writers. Fish and fishing in the West Indies described. Fishing with the remora, folios 21-22, and 211-215.

Copy in N. Y. P.

Edwards, George [1694-1773] A natural history of uncommon birds and of some other rare and nondescribed animals, quadrupeds, reptiles, fishes, insects, etc.; exhibited in 200 copperplates, from designs copied immediately from nature, and curiously coloured after life; with a full and accurate description of each figure. 4 vols. London, 1743-51. 4°.

Pre-Linn. 1743.1

The French version bears title:

— Histoire naturelle d'oiseaux peu communs: et d'autres animaux rares, etc. London, 1745-51.

Pre-Linn. 1745.1

Both editions were issued in parts and are rarely found complete. This work was later republished as "Gleanings of natural history," etc. 1758-64; "Essays upon natural history, etc.," 1770; and "Catalogue of birds, beasts, fishes," etc. 1776. See Edwards, G. 1758.1 and 1776.1.

Egede, Hans [1686-1758] Omstændelig og udførlig relation, angaaende den Grønlandske missions begyndelse og fortsættelse, samt hvad ellers mere der ved landets recognoscering, dets bescaffenhed, og indbyggernes væsen og leve-maade vedkommende, er befunden . . . Kjøbenhavn, 1738. x, 408 p. 4°.

Pre-Linn. 1738.1

Fishes, p. 54-77.

According to Agassiz, the original edition appeared in 1729, and a German translation at Frankfort in the same year. The next Danish edition is entitled:

— Det gamle Grønlands nye perustration, eller naturel historie, og beskrivelse over det gamle Grønlands situation, luft, temperament og bescaffenhed; . . . Kjøbenhavn, 1741. vi, 131 p. 11 pls. & map.

Pre-Linn. 1741.1

Foreign language versions are: German, Hamburg, 1740; Copenhagen, 1742, 1763; Berlin, 1763, 1769; Dutch, Delft, 1746; French, Copenhagen & Geneva, also Paris, 1763. English, London, 1745. Besides these, there are a number of abridgements in various collections of voyages and travels. Of editions noted, the available titles are:

— Description of Greenland, etc. translated from the Danish. London, 1745. 8°.

Pre-Linn. 1745.1

A 2nd ed.: London, 1888. 225 p. 8°.

— Beschrijving van Oud-Groenland, of eigentlijk van de zoogenaamde

Egede, H.

Straat Davis; behelzende deszelfs natuurlijke historie, standsgelegenheid, gedaante, grensscheidingen, veld-gewassen, dieren, vogelen, visschen, enz. Delft, 1746. 4°. Pre-Linn. 1746.1

"Van de zee-dieren, zee-vogels, en visschen, walvisschen enz., bl. 54-67. De haai en andere visschen, bl. 75-77. Van de gewone bezigheden als jagen en visschen en de noodige gereedschappen daartoe, bl. 84-94." — Bosgoed.

"Egede's work is still one of the best existing on Greenland, and claims most of all the title of truthfulness, the author having been no less than 15 years in that country."

Eglini, Raphael. Prophetia halieutica. Tiguri, 1598. Pre-Linn. 1598.1

— Coniecturæ halieuticæ novæ et admirandæ e notis et characteribus terrorum piscium marinorum ad latera, stupendo prodigio insignitorum, desumptæ. Hannover & Frankfort, 1611. 4°. Pre-Linn. 1611.1

— Gedanken von der Begebenheit, welche sich in Thoren im August 1748, mit einigen in Blut verwandelten Fischen zugetragen hat. Danzig, 1749. pl. 4°. Abstract in Jena. Gel. Zeit., 1749, 659. Pre-Linn. 1749.1

Eisenberger, N. F., & Lichtensteger, G. (editors). Piscium, serpentum, insectorum, etc. imagines, quas M. Catesby in posteriore parte operis quo Carolinæ, etc. reddidit historiam naturalem, additis vero imaginibus piscium, etc. ediderunt N. F. Eisenberger et G. Lichtensteger. Norimbergæ, 1750. 109 col. pls. fol. Pre-Linn. 1750.1

Explanation of plates in Latin and German. See Catesby, M., 1777.1 in this section.

Ellis, William [c. 1700-1758] The modern husbandman, complete in eight volumes . . . By William Ellis, Farmer, at Little Gaddesden, in Hertfordshire. London, 1750. 8°. Pre-Linn. 1750.1

Vol. III, pt. II, chap. XIII, "Of fishing for trout," etc. Vol. IV, pt. II, chap. IX, "Of making ponds;" chap. X, "Of fishing in the sea."

An earlier ed. is dated 1744-47. This was preceded by "The practical farmer; or the Hertfordshire husbandman," of which there are editions of 1732 (2nd), 1736, and 1737. Not seen, and not known positively to contain fish and fishing.

Elsner, J. G. De anguillis viviparis. Misc. Acad. Nat. Cur., 1670, 1. dec., observ. 119, 240. Pre-Linn. 1670.1

Elvas, — de. See **Fidalgo de Elvas.**

Engelbrecht, Joh. Dissertationes duæ de pisce Ionæ deglutitore. Leipzig, 1702. 4°. Pre-Linn. 1702.1

Enholm, Johannes Eliæson (respond.) Enfalliga anmärkningar om Ost-Giötha Skäre Boars öfliga fiskesätt i Ostersjön. Inaug. Dissert. [Pehr Kalm, præses] Abo, 1753. 46 p. 4°. Pre-Linn. 1753.1

Pisces, p. 8-20. 2nd ed.: Abo, 1754. 28 p.

Ent, George [1604-1689] Mantissa anatomica, ad piscium pelagiorum cartilagineorum planorum classem spectans. (In Charleton, Gaultier. Onomasticon zoicon, plerarumque animalium differentias & nomina propria pluribus linguis exponens. London, 1668, pp. 197-213.) Pre-Linn. 1668.1

Rana piscatrix dissected and described — 5 figs.; also *Galeus* — figure of digestive tract. Also found in Charleton, G. "Exercitationes, etc.," 1677.

Erasmus, Desiderius [c. 1466-1536] Familiar colloquies of Desiderius Erasmus. Translated by N. Bailey. London, 1725. 12°. Pre-Linn. 1725.1

"Venatio, or fishing with a worm," p. 52-53. "Ichthyophagia, or fish-eating," p. 364-408.

Erhard, George. De cyprino monstroso rostrato. Inaug. Dissert. Jena, 1748. 8 p. pl. Pre-Linn. 1748.1

Escher, H. E. [c. 1626-1710] Beschreibung des Zürich-Sees, wie auch von Erbauung, Zunehmen, Stand u. Wesen löblicher Stadt Zürich, von der Lust und Nutzbarkeit des Sees, von wilden Thieren so sich in und um denselbigen befinden. Zürich, 1692. xx, 416 p. 12°. Pre-Linn. 1692.1

Fish and fisheries of lake Zurich.

Eslenberg, Carl. (respond.) Dissertatio de piscaturis in Oceano Boreali. Londini Gothorum [Lund], 1750. 4°. Pre-Linn. 1750.1

Sven Bring, præses.

Estienne, Charles [1504-1564] De Latinis et Græcis nominibus arborum, fructuum, herbarum, piscium, & avium liber: ex Aristotele, Theophrasto, Dioscoride, Galeno, Aëtio, Paulo Aegineta, Actuário, Nicandro, Athenæo, Oppiano, Aeliano, Plinio, H. Barbaro, & J. Ruelio: cum Gallica eorum nominum appellatione. Parisiis, 1536. 8°. Pre-Linn. 1536.1

This work was many times augmented, edited and reissued. There were 17 eds., in French, 1536-1668; 10 Latin, 1536-1629; 8 German, 1579-1607; 6 Dutch, 1566-1627; 6 Italian, 1586-1677; 3 English, 1606- ; 50 eds. in all, 1536-1677.

Estienne possibly took much of his material from an anonymous work of similar title published at Frankfort in 1536. See Pre-Linn. Anon. 753.

— *Prædium rusticum, in quo cuiusvis soli vel culti vel inculti plantarum vocabula ac descriptiones, earumque conserendarum atque excolendarum instrumenta suo ordine describuntur.* Lutetiae [Paris], 1554. 648 p. 8°.

Pre-Linn. 1554.1

Fish ponds and the rearing of fish.

— *L'agriculture et maison rustique de Charles Estienne, docteur en médecine.* Paris, 1564. 4°.

Pre-Linn. 1564.1

Fish, fish ponds, and fishing considered.

The above seems to be the first French ed. Forty other eds. have been noted as follows: 17 French, 1565–1668; 8 German, 1579–1607; 6 Italian, 1581–1677; 6 Dutch, 1566–1627; 3 English, 1600–1616. However, according to Brunet, 30 eds. (presumably in French) were published at Paris, Lyons and elsewhere between 1591 and 1702. Estienne's work was replaced in 1700 by Liger. (q. v.) Some foreign language versions follow:

— *L'agriculture et case di villa di Carlo Stephano . . . nuovamente tradotta del Cavaliere Hercole Cato.* Venezia, 1581. 4°. Pre-Linn. 1581.1

— *XV Bücher von dem Feldbau, etc.* Strasburg, 1598. fol.

Pre-Linn. 1598.1

— *Hofstede en Landthuys.* Dordrecht, 1662. 4°. Pre-Linn. 1662.1

For further issues, see Estienne, C., & Liebault, J.

"Charles Estienne or Stevens was a member of the celebrated family of Paris printers and scholars of that name, and was himself a printer and physician. His work appears to have been published after he had ceased to print. The treatises, of which it is composed, were originally written in Latin and collected under the title, 'Prædium rusticum.' The author afterwards translated them into French under the title given above. John Liebault, by whom the work was augmented, was his son-in-law." — W. & S.

For titles of the short tracts referred to, see Catalogue British Museum (Natural History), vol. II. The first edition of the completed work appeared in 1554.

Estienne, Charles, & Liebault, Jean [c. 1535–1596] *L'agriculture et maison rustique de Charles Estienne, docteur*

en médecine; augmenté par Jean Liebault. Lyon, 1565. 16°.

Pre-Linn. 1565.1

— *Maison rustique, or the countrie ferme.* Compiled in the French tongue by Charles Stevens and John Liebault, doctors of physicke, and translated into English by Richard Surfleet, practitioner in physicke . . . London, 1600. 4°.

Pre-Linn. 1600.1

Book iv, chaps. xi–xvi have to do with fish-ponds and the rearing of fish.

Other eds.: London, 1606, 1613. fol.

— *L'agriculture et maison rustique. Revue et augmentée . . .* Rouen, 1608. woodcuts. 4°. Pre-Linn. 1608.1

Eustathius, (Saint) (Bishop of Antioch) [c. 270—c. 360] *Commentarius in Hæxameron* (Leo Allatius editor and commentator) Lugduni, 1629. 4°.

Pre-Linn. 1629.1

In his comments on the work of the "6 days" of the first chapter of Genesis, he refers to the sciæna, scarus, echeneis, and the thresher shark.

This seems to be a translation with comments of a similar work by Saint Basil, and is found in the works of the latter; Paris, 1603, & Antwerp, 1616. It is available today in Migne, J. P. *Patrologiæ Græcæ*, Paris, 1847, vol. LIII (Latin); & Paris, 1857, vol. XVIII (Greek and Latin in parallel columns). By some the "Hexameron" is accounted a spurious work.

Euthius, Johannes Aegidius. *De pisce magno, prægrandi & monstroso.* Misc. Acad. Nat. Cur., 1696, 3. dec. 4, observ. 29, p. 76. *Ibid.*, 1697, 3. dec. 5. Pre-Linn. 1696.1

— *De pisce figura vittæ Gallicanæ vulgo Fontange.* Misc. Acad. Nat. Cur., 1697 & 1698, dec. 3, ann. 5 & 6, 145.

Pre-Linn. 1697.1

Evelyn, John [1620–1706] *Diary*, July 23, 1668. Pre-Linn. 1668.1

Under this date is found an identification of bufonites and glossopetras as sharks' teeth.

The earliest edition of this diary is: "Memoirs illustrative of the life and writings of John Evelyn, Esq.; comprising his diary, from 1641 to 1705–06, and a selection of his familiar letters. Edited by W. Bray." 2 vols. London, 1818. 4°.

F

Faber, Joh. (respond.) Disquisitio de Xiphia sive Gladio. Regiomonti [Königsberg] 1693, 22 p. 4°.

Pre-Linn. 1693.1

Phil. Jac. Hartmann, *præses*.

Faber, Johann Matthæus [1626–1702] Observatio de glossopetris. Ephemer. Acad. Nat. Cur., 1676, 1. dec., ann. 6; 7; 8; 9. Pre-Linn. 1676.1

Fabri, B. Epitome 4 librorum C. Gesneri de historia animalium quadrupedum, viviparorum, aquatiliū & volatiliū. Francofurti, 1622.

Pre-Linn. 1622.1

Fabri, Pet. Joh. Operum volumen prius, in quo 1. panchymicum, sive anatomia totius universi; 2. sapientia universalis sive anatomia hominis et metallorum. Frankfort, 1656.

Pre-Linn. 1656.1

In Book I are found certain details concerning fishes.

Fabricius, George [1516–1571] Rerum Misnicarum libri VII. Lipsiæ, 1569. 4 pls. 4°.

Pre-Linn. 1569.1

Names in Latin and German of various fishes of river Albi, p. 220.

Fabricius, Philip Conrad [1714–1774] Commentatio de animalibus quadrupedibus, avibus, amphibiiis, piscibus et insectis Wetteraviæ indigenis. Helmstadii, 1749. 56 p. 8°.

Pre-Linn. 1749.1

— (*præses*) Dissertatio de ichthyocola. Helmstadii, 1756. 28 p. 4°.

Pre-Linn. 1756.1

Stolze, *respond.*

Fabricius d'Aquapendente, Jerome [1537–1619] Tractatus de motu locali animalium secundum totum. Venetiis, 1610. 4°.

Pre-Linn. 1610.1

Other eds.: 1616 & 1618 (Padua).

— De totius animalis integumentis. Padua, 1618. 8°.

Pre-Linn. 1618.1

Another ed.: Königsberg [Regiomonti], 1642.

— Tractatus de formatione ovi et pulli. Padovæ, 1621. Pre-Linn. 1621.1

Discusses mode of reproduction and describes the scales of fishes.

— Opera physico-anatomica prodire. Patavii, 1625. fol.

Pre-Linn. 1625.1

Other Latin eds.: Leipsic, 1678, & Leyden, 1737 or 38; a German version with plates & portrait, Nürnberg, 1673.

"Pauca de generatione et squamis piscium edisserit & figuram galæi dissecti tab. ænea 30 & 31 repræsentavit sed non descripsit." Comment by Walbaum on 1738 edition.

Fahlberg, Algot. Angående åhl-fiskens alstrande och förökelse. K. Svensk. Vet. Acad. Handl., 1750, 11, 194–197.

Pre-Linn. 1750.1

With remarks by Carl de Geer in a footnote. Erroneously credited by Agassiz and others to Fahlberg & de Geer.

— Von der Fortflanzung und Bemehrung der Aale. König. Schwed. Akad. Abhand., 1754, 12, 199–202.

Pre-Linn. 1754.1

See note under Kästner, A. G. this section. Reprinted, *Analecta Transalpina*, Venice, [1762], 2, 298.

Fallours, Samuel. A physician of Amboina, whose drawings of East Indian fishes, according to Cuvier served as the basis of the second volume of Renard's fishes of India. See note under Renard, L., this section, 1718.1.

Farmer, John. The history of the ancient town and once famous abbey of Waltham in the county of Essex, etc. London, 1735. v, 237 p. illust. 8°.

Pre-Linn. 1735.1

Contains some observations on fishes.

Farrington, —. Some account of the charrfish [*Salmo umbla* or *alpinus*], as found in north Wales. Phil. Trans. Roy. Soc., 1755 (1756), 49, 210–212. — London Mag., 1756 (December). — Hamburg Mag., 1756, 19, 373.

Pre-Linn. 1756.1

Fatio, J. Ch. Remarques sur l'histoire naturelle du lac de Genève. Genève, 1730.

Pre-Linn. 1730.1

Fishes of Lake Geneva considered.

Feith, H. O. Brief van Prior Petrus aan Johan van Ewsum, over de zwanen, de visscherij enz. te Roden. 1559.

Pre-Linn. 1559.1

Ferro, Giovanni Maria. *Historia naturale di F. Imperato . . .* In questa seconda impressione aggiuntoui da G. M. Ferro . . . alcune annotationi alle Piante nel libro vigesimo ottavo. Venice, 1672. fol. Pre-Linn. 1672.1

Another ed., 1695. See Imperato, F., in this section.

Feuillée, Louis [1660–1732] *Journal des observations physiques, mathématiques & botaniques faites par l'ordres du Roy sur les côtes orientales de l'Amérique méridionale, & dans les Indes Occidentales, depuis l'année 1707, jusques en 1712.* 3 vols. Paris, 1714–25. pls. 4°. Pre-Linn. 1714.1

Notes on some fishes.

— *Journal d'observations faites dans la Nouvelle Espagne et aux îles de l'Amérique.* Paris, 1725. 4°. Pre-Linn. 1725.1

This may be one of the three volumes of the above. Not seen. Title from Agassiz. A German edition of the whole or one of its parts is:

— *Beschreibung zur Arzeney dienlicher Pflanzen, welche in den Reichen des mittäglichen America in Peru und Chili vorzüglich im Gebrauch sind, nebst verschiedenen andern aus eben-desselben Tageregister physischer Beobachtungen gesammelten und zur natürlichen Historie gehörigen Anmerkungen.* 2 parts (in 1 vol.) Nürnberg, 1756–57. 102 pls. 4°. Pre-Linn. 1756.1

Sharks, flying fishes and various other fishes (10 in number) described.

Fibig, Johann (*præses*) [—1792] *Exercitium juridicum de jure venandi, aucupandi et piscandi.* Jenæ, 1638. 4°. Pre-Linn. 1638.1

S. Scheffer, aus Görlitz, *respond.*

Fidalgo de Elvas. *Relaçam verdadeira dos trabalhos q̃ ho governador dom Fernando de Souto e certos fidalgos Portugueses passarom no descubrimêto da provincia da Florida. Agora novamente feita per hũ fidalgo Delvas.* Evora, 1557. Pre-Linn. 1557.1

This is the very rare first ed. Pre-Linnæan eds. have appeared in English, 1609 & 1686; French, 1685; Dutch, 1706. The first English version is by Richard Hakluyt and is entitled:

— Virginia richly valued, by the description of the mainland of Florida, her next neighbor. London, 1609. Pre-Linn. 1609.1

French has reproduced this work in his "Historical Collections of Louisiana," 1850, pt. II. It may also be found in a Hakluyt Society reprint, 1851. For a more modern version, see:

"Narratives of the career of Hernando de Soto in the conquest of Florida as told by a Knight of Elvas." Translated by Buckingham Smith, New York, 1866.

For observations on the fishes referred to therein, see Gill, T. N., 1866.2.

The "Gentleman of Elvas" was undoubtedly one of the eight Portuguese adventurers from Elvas who accompanied De Soto to Florida, and one of the four who escaped with their lives.

Figulus, Carolus [*fl.* 1540] *Ichthyologia seu dialogus de piscibus.* Coloniae, 1540. 8 p. 4°. Pre-Linn. 1540.1

The persons carrying on the dialogue are C. Figulus and J. Sylus. Some 20 fishes of the Moselle are named in Latin and German, but no descriptions are given. Copy, A. M. N. H.

Figulus, Publius Nigidius [98–45 B.C.] *De animalibus* (In Macrobius, Aurelius Theodosius. *Commentariorum in Somnium Scipionis libri II; Saturnaliorum conviviorum, libri VII.* Venetiis, 1492. fol.) Pre-Linn. 1492.1

According to Walbaum, in book III, chap. xvi, of the "Saturnaliorum," Figulus makes mention of certain fishes.

Another ed. of the above, 1597.

— *De animalibus* (In Rutgers, James. *Variae lectiones.* Lugduni, 1618. 4°.) Pre-Linn. 1618.1

For present day renderings of the fragmentary remains of this author, see:

De P. Nigidii Figuli fragmentis apud scholasten Germanici servatis. Berolini, 1854. 44 p. [A thesis by Alfred Breysig]

P. Nigidii Figuli operum reliquæ. A. Swoboda editor. Vindoboniæ [Vienna], 1889.

Firens, Pierre. *Fasciculus rariorum et continuatio rariorum et aspectu dignorum varii generis quæ collegit et in æs incisi curavit Basil. Besler.* Nürnberg, 1616–22. Pre-Linn. 1616.1

"Enthält Thierabbildungen ohne Stechernamen. Die Tafeln wurden zu dem Gazophylacium des Mich. Aug. Besler benutzt." Reference and note from Carus, J. V., p. 320.

— *Piscium, quadrupedum, avium vivæ icones in æs incisæ et editæ a Petro Firens.* (c. 1650). 4°. Pre-Linn. 1650.1

Engraved title-page and 19 engravings of fishes.

Fischer, — (*respond.*) *Dissertatio de piscibus.* Coburgi, 1679. 4°. Pre-Linn. 1679.1

J. C. Fromman, *præses.*

Fischer, C. *Fleissiges Herren Auge, oder wohl ab- und angeführter Haushalter; das ist gründlicher Unterricht von Führung eines nützlichen Landlebens und Wirthschaft von Feld- und Ackerbau, Fischerei und Teiche.* Frankfurt, 1690. 4°. Pre-Linn. 1690.1

Another ed.: Nürnberg, 1696. 3 pts. 4°.

Fischer, Christian Gabriel [c. 1690–1751] *Dissertatio de bufonite. Regiomonti* (Königsberg), 1714. 4°.

Pre-Linn. 1714.1

Bufonites are fishes' teeth.

— *Par lapidum: ætites et bufonites. Regiomontani*, 1715. 4°.

Pre-Linn. 1715.1

Fischer, Francis Melchior. *Dissertatio de jure piscandi. Argentorati* [1719] 22 p. 4°.

Pre-Linn. 1719.1

Fischers, Salamon von Azendorff. *Oeconomische Schatz-Kamer in 4 Theilen bestehend. Hanover*, 1716. 8°.

Pre-Linn. 1716.1

Is concerned with fish and fisheries.

Flacourt, Etienne de [1607–1660] *Histoire de la grand isle Madagascar, etc. Paris*, 1661. xxi, 471 p. 10 pls. 6 maps.

Pre-Linn. 1661.1

Fishes, chapter xli.

First ed.: Paris, 1658.

Flamen, Albert B. *Icones diversorum piscium tum maris tum omnium ab Alb. Flamen ad vivum delineati, et in æs ab eodem artificiose incisi. . . . Figures de plusieurs sortes de poissons tant de mer, que de l'eau douce designez et graves sur le naturel, par Albert Flamen, etc. Paris*, 1664. obl. fol.

Pre-Linn. 1664.1

This is the general title of the following 6 parts.

i. *Diverses espèces de poissons de mer, etc.* 12 pls.

ii. *Seconde partie de poissons de mer.* 12 pls.

iii. *Troisième partie de poissons de mer.* 12 pls.

iv. *Diverses espèces de poissons d'eau douce.* 12 pls.

v. *Seconde partie de poissons d'eau douce.* 12 pls.

vi. *Diverses espèces de poissons, tant de mer, que d'eau douce.* 7 pls.

— *Diverses espèces de poissons d'eau douce, etc. Paris*, 1710. obl. fol.

Pre-Linn. 1710.1

Engraved title-page and sixteen engravings of fish and fishing.

Not seen. Title entirely isolated. Possibly a reprint of some part of the above.

Flemming, H. F. von. *Vollkomener deutscher Jäger und Fischer. Leipzig*, 1719. 2 parts. pls. fol.

Pre-Linn. 1719.1

Other eds.: Leipsic, 1724, 1748, 1749.

— *Der wohl unterrichtete deutsche Fischer, welcher Anleitung giebt, wie die Teiche anzulegen, die Fischereyen anzustellen, und allerhand Fische beschreiben, etc. Leipzig*, 1724. fol.

Pre-Linn. 1724.1

Forer, Conrad or Cunrat (translator) *Gessners Fischbuch. Die ausführliche Beschreibung und lebende Conterfactur aller und jeder Fischen. Durch C. Gessner in Latein erstmals beschrieben, hernach von C. Forer ins Teutsch gebracht. Zürich*, 1563. vi, 202 Blätter. fol.

Pre-Linn. 1563.1

Forer's German version was also issued at Zurich, 1563 (2nd ed.), 1575; Frankfurt, 1598; & Heidelberg, 1606.

See also Gesner, C., this section.

Fortin, François. *Les ruses innocentes, dans lesquelles se voit comment on prend les oyseaux . . . & de plusieurs sortes de bestes . . . Avec les plus beaux secrets de la pesche dans les rivières & dans les estangs. Et la manière de faire tous les rets & filets qu'on peut s'imager. Par F. F. R. D. G. dit le Solitaire Inventif. [F. Fortin]. Paris*, 1660. xvi, 288, 54 p. 4°.

Pre-Linn. 1660.1

The initials used by the author are thus interpreted: Frère François Fortin, religieux de Grandmont.

Copy, N. Y. P.

Other eds.: Paris, 1688; Amsterdam (2 separate eds.), 1695. 2 vols. Next as:

— *Délices de la campagne, ou les ruses de la chasse et de la pêche, . . . avec les plus beaux secrets de la pêche et la manière de faire les rets et les filets, augmenté d'un dictionnaire de tous les termes de chasse, de pêche et de filets, . . . 2 vols. Amsterdam*, 1694.

Pre-Linn. 1694.1

Other eds.: 1699, 1700, 1732.

On this work Louis Liger based his "Amusemens de la campagne." In fact several editions of his work reproduced in its entirety volume one of "Les ruses." See Liger, Louis, this section.

Fournival, Richard de [fl. 13th or 14th cent.] . . . *De vetula. (Rome?, c. 1470).*

Pre-Linn. 1470.1

This work, now known to be by De Fournival, was formerly attributed to Ovid, and was first printed, probably at Rome, in 1470, under the title "P. Ovidii Nasionis liber de vetula," and at Cologne, 1479. Afterward the authorship came into doubt, for it was combined with another work and published under the title "Brunellus Vigelli, et vetula Ovidii, seu opuscula duo auctorum incertorum," etc. Wolferbyti, 1662.

The "De vetula" was translated into French by Jean Lefevre about the middle of the 14th century and remained in MS. until 1855 when it was published in Paris. A later and more critical edition was issued by Aubry in his "Trésor de pièces rares ou inédites" as:

La vieille, ou les dernières amours d'Ovide, poème français du xiv^{me} siècle traduit du Latin de Richard de Fournival . . . et précédé de recherches sur l'auteur du Vetula, par Hyppolyte Cocheris. Paris, 1861.

The passage in "La Vieille," which treats of fishing is headed "Comment Ovide tendait aux poissons," and consists of 68 lines.

"De Fournival's work cannot but be interesting to the angling bibliophile, as showing that more than four hundred years ago (and probably about a hundred and fifty years before the date of the 'Book of St. Albans') most of the modern modes of fishing were practised; for instance: the worm, the fly, the torch and spear, the night-line, the eel-basket and fork, etc." — W. & S.

Francese, Gio. Germano. Trattato alle figure anatomiche della piu principali animale terrestri, aquatili, e volatili, con la simpatia convenienza che hanno, o in parte, o in tutto con il corpo humano. Neapoli, 1625. fol. figs.

Pre-Linn. 1625.1

Franciscus, Erasmus [1627–1694] Ost- und West-Indischer, wie auch Sinesischer Lust- und Stats-garten, etc. In drey Haupt-Theile unterschieden. Nürnberg, 1668. xxxvi, 1762 p. 66 pls. fol.

Pre-Linn. 1668.1

Härings-fang ausführlich beschrieben, p. 25–29. Beschreibung verschiedener Fische, p. 21–35; 150–153; 449; 452; 681; 926; 960; 986; 999; 1027; 1392. Sinesische Fische, p. 1422. Der Torpedo, p. 1422.

— Guineischer und americanischer Blumen-Pusch, welcher einen ergetzlichen Geruch mancherley mercklicher Eigenschafften, wunderlicher Thiere, Vögel, Fische, fremderweisen Sitten Gebräuche selbiger Länder . . . Nürnberg, 1669. 399 p. pls. 8°.

Pre-Linn. 1669.1

Fishes and fishing, chap. xi, p. 221–239.
Copy, A. M. N. H.

Francus, Antipas. Divinorum characterum halecum (herring) duarum in littore Nortwegico 1587 captarum vera lectio et explicatio. 1591. 4°.

Pre-Linn. 1591.1

Frank, Richard [1624–1708] Northern memoirs, calculated for the meridian of Scotland. . . . Together with choice collections of various discoveries . . . observations, theological notions. . . . To which is added, The contemplative and practical angler. . . . Writ in the year 1656, etc. London, 1694. xxix, 304 p. 16°.

Pre-Linn. 1694.1

Reviewed in Retrospective Review, 8, 170–194. A new ed., with preface and notes by Sir Walter Scott. Edinburgh, 1821.

Copies of both eds., N. Y. P.

Frankenau, Georg Frank von (præses) [1643–1704] Dissertatio de anguillis. Medic. Siles. Satyra, Argentorati [Strassburg], 1673. 4°.

Pre-Linn. 1673.1

Matthæus, respond.

Not seen; title from Walbaum. Agassiz gives date, 1675. Walbaum & Boehmer say Heidelberg, 1675.

Franz, or Frantzius, Wolfgang [1564–1628] Animalium historia sacra, in qua plerorumque animalium præcipuæ proprietates in gratiam studiosorum, etc., breviter accomodantur. In academia Wittebergensi ante annos aliquot dictata etc. Jam denuo emendatius et correctius edita; triplici indice, scilicet capitum, rerum et locorum e scriptura, nec non adagiorum aucta. Amstelodami, 1643. 638 p. 12°.

Pre-Linn. 1643.1

De piscibus, p. 413–484. Copy, U. T. S. Other eds.: Wittebergæ, 1616, 1624, 1633, 1642, 1649, 1659; Amstelodamæ, 1641, 1643, 1658, 1665; Lipsiæ, 1688; Francofurti, 1712 (5 vols.).

Frascatorius, Hieronymus. Liber i. De sympathia et antipathia rerum. Lugduni, 1550.

Pre-Linn. 1550.1

Ship-holder, p. 24. Copy, C. P.

— Opera omnia. Venetiæ. 1555. 4°.

Pre-Linn. 1555.1

Another ed.: Venetiæ, 1584. 4°.

Freigius, Johannes Thomas [1543–1583] Quæstiones physicae, in quibus methodus doctrinam physicam legitime docendi, describendique, rudi minerva descripta est libris xxxvi. Basel, 1579. 8°.

Pre-Linn. 1579.1

"Horum liber xxxiii agit de piscibus & ichthyographia & ichthyographis."

Other eds.: Basel, 1582 & 1585.

Frey, Heinr. Herm. ICHTHYO-BIBLIA darinn die Fische, deren in der Bibel gedacht wird, sampt ihren Eigenschafften und abhangenden nützlichen Historien, beschrieben sind, etc. Leipzig, 1594. 66 p. woodcuts. 4°.

Pre-Linn. 1594.1

Jonah and the great fish, p. 30–49.

— THEROBIBLIA; Biblisch Thierbuch, darinnen alle vierfüssige, zahme, wilde, giftige und kriechende Thier, Vogel und Fisch (deren in der Bibel meldung geschicht) etc. beschrieben sind. In drei unterschiedene Bücher abgetheilet, und mit schönen Figuren (in Holzschn.) gezieret. Leipzig, 1595, 383 p. 4°.

Pre-Linn. 1595.1

"Biblisch Fischbuch," 1594, above is bound herein as section III without change of date. A copy of this rare old book in A. M. N. H.

Frézier, Amédée Franç. [1682–1773] Relation du voyage de la Mer du Sud aux côtes du Chili et du Perou, fait pendant les années 1712–14. Paris, 1716. 37 figs. 4°.

Pre-Linn. 1716.1

English & Dutch versions are:

— A voyage to the South Sea, and along the coasts of Chili and Peru in the

Frézier, A. F.

years 1712, 1713, 1714. London, 1717.
4°. Pre-Linn. 1717.1

Fishes, p. 8, 27, 82, 121. Plate of fishes (including *Callorhynchus*), to face p. 21.

— Riis-beschryving door the Zuid-zee langs de Kusten van Chili, Peru, en Brazil . . . in de j. 1712-14. Amsterdam, 1718. 4°. Pre-Linn. 1718.1

Other eds.: Amsterdam, 1717, 1727; Paris, 1717, 1732; Hamburg, 1718, 1749 (German); London, 1718. Also reprinted in Arkstee, & Merkus. "Allgemeine Historie der Reisen, etc." 1754-57, Bd. xii & xv, under title "Reise . . . durch die Strasse Le Maire, 1711-14."

Frisch, Jodocus Leopold [1714-1787] *Musei Hoffmanniani petrefacta et lapides, oder Beschreibung der versteinerten Dinge und anderer raren Steine, welche in dem Kabinet . . . Fr. Hoffmann's befindlich.* Halæ, 1741. x, 119 p. figs. 4°. Pre-Linn. 1741.1

Fossil fishes and sharks' teeth, p. 73, 76, 107. Reviewed in Leipzig. *Gel. Zeitg.*, 1842, p. 54.

Frisch, Joh. Leonhard [1666-1743] *De tæniis in piscibus.* Misc. Berol., 1727, 3, 43-44. fig. Pre-Linn. 1727.1

See also Frisch, J. L., Add., 1781.2.

— *Vestigia generationis tæniarum sive vermium latorum in piscibus et avibus, item de lubricis et tæniis in superfici hepatis et murium, etc.* Misc. Berol., 1727, 3, 44-46. fig. Pre-Linn. 1727.2

See also Frisch, J. L., Add. 1781.1.

— *De mustelæ fluviatilis [Lota vulgaris] et de tæniis in stomacho hujus piscis.* Misc. Berol., 1734, 4, 392-393. Pre-Linn. 1734.1

— *De tæniis in pisciculo aculeato, qui in Marchia Brandenburgica vocatur Stecherling.* Misc. Berol., 1734, 4, 395-396. Pre-Linn. 1734.2

See also Frisch, J. L. Add., 1781.4.

— *De Gobio capitato,* Keuling, Kolbe, Kaulhaupt. Misc. Berol., 1740, 6, 123. Pre-Linn. 1740.1

— *De ossibus dentatis in utraque pinna ventris carpionis.* Misc. Berol., 1740, 6, 122. Pre-Linn. 1740.2

— *De tæniis quæ in jecore piscium inveniuntur, imprimis vero in lucio pisce.* Misc. Berol., 1740, 6, 129. Pre-Linn. 1740.3

See also Frisch, J. L. Add., 1781.3.

— *Observationes ad lampetrarum tres species.* Misc. Berol., 1740, 6, 118-120. pl. Pre-Linn. 1740.4

"i. Ad vulgo oculatam sive septem spiraculis.
ii. Ad barbatam, Steinbeisser mit dem Bart.
iii. Ad aculeatam sive pangentem."

Fritsch, Ahasuer. *Corpus juris venatorio-forestalis.* 3 parts. Lipsiæ, 1702. fol. Pre-Linn. 1702.1

Part 1 includes *Mor de Nigro Monte*, George, Pre-Linn. 1602.1 (q. v.).

Froger, François [1676-1715] *Relation d'un voyage fait en 1695-97 aux côtes d'Afrique, détroit de Magellan, Brésil, Cayenne & isles Antilles par une escadre des vaisseaux du roi, commandée par M. de Gennes, fait par le Sieur Froger.* Paris, 1698. xii, 227 p. ill. 8°. Pre-Linn. 1698.1

"Pisces aliquos depictos paucisque verbis descriptos habet sub nominibus Bourse (*Balestes*) Porcepic de mer (*Hystrix*) Sucet (*Eche-neis neucrates*)" — Walb.

Other eds. in French, Amsterdam, 1699 and 1715, are practically identical with the above. English and German versions are:

— *Voyage to Africa, Straight of Magellan, Cayenne, the Antilles, etc.* London, 1698. 12°. Pre-Linn. 1698.2

— *Froger's Reise oder Nachricht von den Genes Reise nach der Magellanschen Strasse* (In Arkstee & Merkus. *Allgemeine Historie der Reisen, etc.* 1754.) Pre-Linn. 1754.1

Fromman, Johann Christian (*præses*) *Dissertatio de piscibus.* Coburgi, 1679. 4°. Pre-Linn. 1679.1

Fischer, *respond.*

Fron dius, Elias (*præses*) *Disputatio de piscaturâ harengorum in Roslagiâ.* Inaug. Dissert. Upsaliæ, 1745. 4°. Pre-Linn. 1745.1

Nils Humble, *respond.*

Fryer, John [—1733] *A new account of East India and Persia in eight letters, being nine years travels, begun 1672, and finished 1681.* London, 1698. ill. fol. Pre-Linn. 1698.1

For fishes, see indices and marginal references. Abstract in *Phil. Trans. Roy. Soc.*, 1698, 20, 338-348.

Füessli, Joh. Melchior. *Eigentliche Abbildung aller in dem Zürich-See und der Limmat sich befindenden Gattung Fischen, in welchen Monaten selbige, wie hier verzeichnet, wegen des Laiches und Fasels zu fangen, zu kaufen und zu verkaufen verboten sind.* Zürich, 1709. Pre-Linn. 1709.1

Listed also under Stiefeinus, J. M., by H. Fischer-Sigwart in "Poissons," *Fauna Helvetica*, cahier 5; *Bibliographie Nationale Suisse*, 1900, fasc. IV 6, p. 52.

Funnell, William. A voyage around the world, containing an account of Captain Dampier's expedition into the South Seas . . . in the years 1703 and 1704, etc. London, 1707. 8°.

Pre-Linn. 1707.1

A number of fishes are poorly figured and poorly described.

Another ed. is:

— A voyage round the world, being an account of W. Dampier's expedition into the South Seas (1703–1706). (In "A collection of voyages." 4 vols. London, 1729, vol. IV. 208 p. pls. 8°.)

Pre-Linn. 1729.1

G

G., C. The secrets of angling; imparting the best and choicest experiments for taking all sorts of fish, with fly, worm, paste and other baits; also to know their haunts and how to angle for them in all waters and weathers. By C. G. a brother of the angle. London, 1705. 24 p. 16°.

Pre-Linn. 1705.1

Galenus, Claudius [130–200] *Opera medica* (Edited by Diomedes Bonardus and L. Malatinus). Venice, 1490. fol.

Pre-Linn. 1490.1

This seems to be the 1st ed. of Galen's works. Another is:

— *Opera omnia, ad fidem complurium et perquam vetustorum exemplariorum . . . emendata atque restituta* (by H. Gemusæus, L. Fuchsius and J. Camerarius). 5 parts (in 4 vols.) Basiliæ, 1538. fol. Pre-Linn. 1538.1

In his "De alimentorum medicinalia," vol. III, chaps. 24–31, Galen speaks of a large number of fish relative to the qualities of their flesh as food. The "De alimentorum" was separately published as:

— *De alimentorum facultatibus Libri III. Ex Martini Gregorii interpretatione pluribus in locis, hac additione emendata.* Lugduni Batavorum (Leyden), 1633. 24°. Pre-Linn. 1633.1

One of the earliest commentaries on the names of fishes mentioned by Galen, Dioscorides and other ancient writers on medicine and natural history is that by Charles Estienne, published at Paris in 1536. See Estienne, C., 1536.1.

For a modern commentary on the fishes mentioned by Galen and Xenocrates, see Koraes, A., 1809.1.

Gamon, Christophle de [1576–1621] *Les pescheries de Christophle de Gamon, divisées en deux parties. Où sont contenus, par un nouveau genre d'écrire, et sous des aussi beaux que divers enseignemens, les plaisirs inconnus de la mer, et de l'eau douce.* Lyon, 1599. 142 leaves. 12°. Pre-Linn. 1599.1

Gardiner, Samuel. A booke of angling, or fishing, wherein is shewed, by conference with scriptures, the agreement betweene the fishermen, fishes, fishing of both natures, temporall and

spirituall, etc. London, 1606. 162 p. 16°.

Pre-Linn. 1606.1

"Fishing spiritualized."

Garsin, Laurent. Description d'une sangsue de mer (*Hirudinella marina*) trouvée dans l'estomac d'une bonite. Mém. Acad. Sci. Paris, 1730, hist., 43. — Phil. Trans. Roy. Soc., 1730, 387.

Pre-Linn. 1730.1

Gauchet, Claude Dampmartinois. (*Aumonier du Ruy.*) *Le plaisir des champs, devisé en quatre parties selon les quatre saisons de l'année; où est traité de la chasse et de tout autre exercice récréatif, honeste et vertueux.* Paris, 1583. 4°. Pre-Linn. 1583.1

Contains a chapter, "La pescherie."

Another ed.: Paris, 1604.

Gautier d'Agoty, Jacques Ant. *Observations sur la physique, l'histoire naturelle et la peinture.* 6 vols. 1752–1755. Pre-Linn. 1752.1

The author reproduced in this work a number of Plumier's paintings of West Indian fishes not elsewhere published.

— Collection de [45] planches d'histoire naturelle en couleur, d'après les animaux, les plantes & les minéraux les plus rares &c. Paris, 1757. 4°. Pre-Linn. 1757.1

The viscera of the Dorado, pls. 40 & 41.

These plates, like the above, are probably Plumier's.

Gaza, Theodorus [c. 1400–1475] A native of Thessalonica, the capture of his native city by the Turks in 1430 drove him to Italy where he became professor of Greek in the University of Ferrara in 1447. From 1450–1455, he lived in Rome and under the patronage of Pope Nicholas V translated Aristotle, Theophrastus, and other Greek authors into Latin. See reference to him under Aristotle.

Geer, Carl de [1720–1778] (On reproduction in the eel) K. Svensk. Vet. Acad. Handl., 1750, 11, 196–197. — König. Schwed. Akad. Abhand., 1750 (1754), 12, 201–202.

Pre-Linn. 1750.1

Gentleman of Elvas (*The*). See **Fidalgo de Elvas**.

Geoffroy, Claude Joseph [1685–1752] Description d'un tenia trouvé dans une tanche fort saine. *Mém. Acad. Sci. Paris*, 1710, hist., 39.

Pre-Linn. 1710.1

— Observation sur soixante-six petits poissons, sortis vivans par une membrane rompue d'un poisson qu'on croit être le *Galeus piscis*. *Mém. Acad. Sci. Paris*, 1719 (1721), hist., 40.

Pre-Linn. 1721.1

— Suite de l'examen chimique des chairs des animaux, ou de quelques-unes de leurs parties, etc. *Mém. Acad. Sci. Paris*, 1732 (1735), 17–30.

Pre-Linn. 1735.1

Flesh of carp and pike analyzed.

— Observation sur les dents de lamie ou *Carcharias*. *Mém. Acad. Sci. Paris*, 1741, hist., 34.

Pre-Linn. 1741.1

Geoffroy, Etienne François. Premier mémoire sur l'organe de l'ouïe des reptiles, et de quelques poissons que l'on doit rapporter aux reptiles. *Mém. Math. Phys. Scavans et Etrangers*, Paris, 1755, 2, 164–196. 3 pls. — *Uitgez. Verh.*, 1760, 5, 297–350.

Pre-Linn. 1755.1

This title replaces the citation credited to Geoffroy-Saint-Hilaire, Etienne François [who should be designated Etienne] 1786.1, which is erroneous.

Gerald de Barri. See **Giraldus Cambrensis**.

Gerbezius, Marc. Piscium copia sterilitatis prænuncia. *Eph. Nat. Cur.*, 1694, dec. 3, an. 1, 226.

Pre-Linn. 1694.1

Gering, Johann Gabriel (*respond.*) Dissertatio medico-physica de piscibus. . . . submittit alumnus regius . . . Upsaliæ, 1727. 26 p.

Pre-Linn. 1727.1

L. Roberg, *præses*.

Anatomy described for *Lampetra*, *Anguilla*, *Silurus*, *Acus*, *Asellus*, *Salmo*, *Spirinchus*, and *Albula*.

Germain, J. Breve e sustatale trattato intorno alle figure anatomiche delli piu animali terrestri aquatili e volatili. Neapoli, 1625. fol.

Pre-Linn. 1625.1

Not seen. Title from Haller. Probably the same as Germano, F. G. (q. v.).

Germano, F. Girol. Figure anatomiche delle più principali animali terrestri, aquatili e volatili, colla simpatia e convenienza che hanno, o in parte, o in tutto, con il corpo umano. Napoli, 1625. fig. fol.

Pre-Linn. 1625.1

Title from Agassiz and Boehmer. See also Germain, J., above.

Gesner, Conrad [1516–1565] For life of the man whom Cuvier designated as “le plus savant naturaliste du seizième siècle,” see the contemporary biography by J. Simler, Zurich, 1566; also by J. Hanhart, Winterthur, 1824; also Lebert's “Gesner als Arzt,” Zurich, 1854. More accessible is C. H. Smith's memoir in Jardine's *Naturalist's Library*, vol. XXXI, 1834–43 issue; vol. XX of 1845–46 edition. See also Brooks, W. K. 1895.1. For shorter sketches, see Locy, W. A., 1908.1; and Miall, L. C., 1912.1.

Gesner's great natural history, “*Historia animalium*,” was published in Zurich in 5 parts, 1551–87. fol. It comprises a total of about 4,500 folio pages, and is illustrated by hundreds of woodcuts. The various parts of the history were often reprinted in full or in abridged form and were frequently translated. A complete second edition was issued at Frankfort, 1617–20.

For title of part III, “*De piscium*,” etc., and for reprints and editions of this, see below.

— *De piscibus et aquatilibus omnibus libelli III novi*. I. Scholia et emendationes in *Halieuticon* P. Ovidii Nasonis. II. *Aquatilium animantium enumeratio juxta Plinium, emendata et explicata, serie literarum*. III. *Eorundem nomenclator Germanicus longe copiosissimus. Et alia quædam ad piscium historiam pertinentia*. Tiguri, 1556. vi, 280 p. 18 pls. 8°.

Pre-Linn. 1556.1

Not seen. Title so reads in Walbaum, Gronow, and Carus & Engelmann. Two other variants are given (the first from Agassiz).

Ovidii *Halieuticon*, hoc est de piscibus libellus, multo quam ante hac emendatior et scholiis illustratus. Accedit *aquatilium animantium enumeratio juxta Plinium, etc.* Tiguriæ, 1556. iv, 280 p. 8°.

P. Ovidis Nasonis, de piscibus libellus, multo quam ante hac emendatior & scholijs illustratus; emendatur Plinii aliquot loca; accedit *aquatilium animantium enumeratio iuxta Plinium, emendata & explicata per Conradum Gesnerum, ordine alphabetico; eorundem nomina Germanica, eodem ordine*. Tiguri, [1556]. vi, 280 p.

According to Westwood & Satchell, this compilation is appended to an edition of Ovid's “*Halieuticon*.” The running title is, “*Tütsche*

Gesner, C.

Namen der Fischen und Wasserthieren." An extremely valuable list. In it the fish called "Killinck" in the early Flemish "Boeckxen" is identified as the gudgeon. Some English names are included.

— *Historiæ animalium liber III, qui est de piscium & aquatiliū animantium natura . . .* Tiguri, 1558. 1297 p. figs.

Pre-Linn. 1558.1

This work forms book III of the "*Historiæ animalium*." Other eds.: Frankfort, 1604 & 1620; & Heidelberg, 1606; 1712.

— *Nomenclator aquatiliū animantium. Icones animalium aquatiliū in mari & dulcibus aquis degentium, plus quam DCC. cum nomenclaturis singulorum Latinis, Græcis, Italicis, Hispanicis, Gallicis, Germanicis, Anglicis, aliisque; interdum per certos ordines digestæ. Explicantur autem singulorum nomina ac nominum rationes, præcertim in Latina et Græca lingua uberrimè; et nominum confirmandorum causa descriptiones quorundam, et alia quædam, præsertim in magno nostro De aquatilibus volumine non tradita, adduntur: deque singulis Rondeletii, Bellonii, Salviani et nostræ sententiæ explicantur brevissime . . .* Tiguri [Zurich], 1560. xiv, 374 p. woodcuts. fol. Pre-Linn. 1560.1

In this work, usually cited as "*Icones animalium aquatiliū*," the text is much reduced from that of the "*Historiæ animalium*," liber III, 1558, but the woodcuts are with few exceptions the same.

First ed.; another, Heidelberg, 1606.

— *Fischbuch, das ist ein kurtze doch vollkomne Beschreybung aller Fischen so in dem Meer unnd süßen Wasseren, Seen, Flüssen oder anderen Bächen jr Wohnung habend, sampt jrer waaren Conterfactur: zü Nutz und Gütem allen Artzeten etc. gestellt, insonders aber denen so ein Lust habend zü erfahren und betrachten Gottes wunderbare Werck in seinem Geschöpften. Erstlich in Latein durch Cünradt Gässner beschriben yetz neüwlich aber durch Cünradt Forer etc. in das Teütsch gebracht.* Zürich, 1563. ix, 404 p. woodcuts. fol. Pre-Linn. 1563.1

First ed. of Forer's version of the "*De piscium*." Others are: Zurich, 1563 (a separate issue) & 1575; Frankfort, 1598; & Heidelberg, 1606. However, entirely apart from these are the versions immediately following the next title.

— *De rerum fossilium, lapidum et gemmarum maxime . . . liber, &c.* Tiguri, 1565. xiv, 169 p. (In Gesner, C. (editor). *De omne rerum fossilium genere, gemmis, lapidibus, metallis et*

hujus-modi, libri aliquot, &c. Tiguri, 1565-(66). 8°. Pre-Linn. 1565.1

This volume contains the works of 7 other authors.

— Thier-, Vogel-, Fisch- und Schlangenbuch (8 parts) Zürich, 1575-89. woodcuts. fol. Pre-Linn. 1575.1

— *L'histoire des animaux à quatre pieds, des oiseaux, des poissons, . . .* de Gesner. Paris, 1619. figs. fol.

Pre-Linn. 1619.1

Gesner, Johann Matthias (editor) [1691-1761] *Scriptores rei rusticæ veteris Latini. . . et lexicon rei rusticæ curante J. M. Gesner.* 2 vols. Lipsiæ, 1735. 4°. Pre-Linn. 1735.1

Here are collected the "*De re rustica*" of various authors elsewhere referred to. The works of these "old farmers," as D. G. Mitchell calls them, have references to fish and fishponds. Another and the most celebrated edition is that of 1787, the contents of which are:

Vol. I. [Preface by Gesner and lives of the several authors, &c.].

M. P. Catonis de re rustica.

M. T. Varronis de re rustica libri III.

Vol. II. L. J. M. Columellæ de re rustica libri XII, et de arboribus.

Vol. III. Palladii Rutilii Tauri Aemiliani de re rustica libri XIV. Vetetii renati artis veterinariæ liber IV. A. Popmæ Frisi de instrumento fundi liber.

Vol. IV. *Lexicon rusticum.*

— *Tractatus physicus de petrificationis, etc.* Lugduni Batavorum, 1758. 8°. Pre-Linn. 1758.1

Fossil sharks' teeth, p. 61.

Geyer, Johannes Daniël [1660-1735] *Targelus Apollini facer continens trigam medicam e regno animali & vegetabili: I. De cantharidibus. II. De montibus conchiferis & glossopetris Alzeiensibus archipalatinis. III. De dictamno.* Lipsiæ, 1687. figs. 4°. Pre-Linn. 1687.1

"*De glossopetris*" [fossil sharks' teeth] found also in Valentini, M. B. "*Historia litteraria . . . Academiæ Naturæ Curiosorum, etc.*" Gissæ, Hassorum, 1708.

— Müssiger *Reise-Stunden gute Gedancken von denen Brsczenischen Carthausern der Litthauischen Carthaus Paradis, und der Ichthiophagia quadragesimali.* 17. Discours. Dresden, 1735. 4°. Pre-Linn. 1735.1

Giannettasius, Nic. Parthenius. *Piscatoria et nautica.* Napoli, 1685. 8°. Pre-Linn. 1685.1

Other eds.: Napoli, 1686, 1692.

— *Halieutica.* Napoli, 1686. 8°. Pre-Linn. 1686.1

Other eds.: Napoli, 1689, 1696.

Both included in an ed., Naples, 1710-22.

Gilbert, William. The angler's delight, containing the whole art of neat and clean angling; wherein is taught the readiest way to take all sorts of fish, from the pike to the minnow, together with their proper baits, haunts, and time of fishing for them, whether in mere, pond, or river, etc. London, 1676. 45 p. 12°. Pre-Linn. 1676.1

— The young angler's companion. Containing the whole art of neat and clean angling . . . The like never before in print. London, 1682. 45 p. 12°. Pre-Linn. 1682.1

Reprinted, London, 1776. Copy, 1682 ed., N. Y. P.

Gilles, or Gylles (Lat. **Gillius**), *Pierre* [1490–1555] For a biographical notice and analysis of his books, see Hamy, E. T. in *Nouv. Arch. Mus. Hist. Nat. Paris*, 1900, 4. sér. 2, 1–24.

— *Ex Aeliani historia per Petrum Gyllium Latini facti, itemque ex Porphyrio, Heliodoro, Oppiano, tum eodem Gyllio loculentis accessionibus aucti libri xvi. De vi et natura animalium; ejusdem Gyllii liber unus, de gallicis et latinis nominibus piscium.* Lugduni [Gallorum], 1535. 599 p. 4°. Pre-Linn. 1535.1

— *De nominibus gallicis et latinis piscium massiliensium.* Lyon, 1535. Pre-Linn. 1535.2

This, which in the copy examined, is added as a sort of preface to the preceding, seems to have been in MS. as early as 1533. It contains the common names, ancient and contemporary, of 93 Mediterranean fishes.

A naturalist and traveller, Gilles examined the fishes of the Mediterranean and Adriatic; he also published Aelian in Latin, rearranging his matter, and identifying the species where possible. By some he has been called "le père de la zoologie française."

Gillmore, J., & Steele (Sir) *R.* See **Steele & Gillmore.**

Gimma, Giacinto. Della storia naturale delle gemme, delle pietre, e di tutti i minerali, ouvero della fisica sotterranea. 2 vols. Naples, 1730. 551, 603 p. 4°. Pre-Linn. 1730.1

Vol. I, book iv, p. 433. *Lapides piscium.*

Vol. II, book I, p. 1 *Glossopetra.*

Giovio, (Lat. Jovius), Benedetto [1472–1544] *De Laris lacu et ejus piscibus carmen.* Romæ, 1524. fol. Pre-Linn. 1524.1

This poem on the fishes of lake Como is also found in the 1561 and 1578 editions of the collected works of Paolo Giovio, his brother. Also in "Thesaurus antiquitatum et historiarum Italiæ." Lugduni Batavorum, 1704.

Giovio, or Jovius, Paolo [1483–1552] For biographical sketches, see Müntz, Eug. in *Arch. Stor. Ital.*, 5. ser. 19; and Sanesi, Guiseppe. *Ibid.*, 23; also *Encyclopædia Britannica*, 11. ed. 1911, vol. XV, 526–527.

— *De romanis piscibus libellus; . . . accedunt antiqua et recentiorum nomina piscium marinarum, lacustrum et fluviatilium, quæ in Jovii commentariis continentur.* Romæ, 1524. fol. Pre-Linn. 1524.1

The 1st ed.; another, Basel, 1526.

— *Liber de piscibus marinis, lacustribus, fluviatilibus, item de testaceis et salsamentis.* Romæ, 1527. 4°. Pre-Linn. 1527.1

This work treats of the river, lake and marine fishes (especially Adriatic) of Italy. It passed through many eds.: Basel, 1531, 1545, 1571; Rome, 1554, 1560, 1584; Antwerp, 1528; Strasbourg, 1534 (Copy, A. M. N. H.); Paris, 1649; Venice, 1731. An Italian version is entitled:

— *Libro di Mons. Paolo Giovio de' pesci Romani, tradotto in volgare da carlo Zancaruolo . . .* Venetia, 1560. 198 p. 8°. Pre-Linn. 1560.1

— *Descriptio Larii lacus.* Basileæ, 1561. fol. Pre-Linn. 1561.1

Also found in "Thesaurus antiquitatum et historiarum Italiæ." Lugduni Batavorum, 1704, vol. III.

— *Opera.* Basel, 1578. Pre-Linn. 1578.1

The best ed.; an earlier, Basel, 1561.

Giraldus Cambrensis or Gerald de Barri [1146–1220] *Topographia Hibernica.* (Published with Holinshed's Chronicle, 1587. fol.) Pre-Linn. 1587.1

Pisces marini, cap. ix.

This work, written c. 1186, remained in MS. until published in 1587. For a modern edition of the works of Giraldus, see that in 8 vols. edited by J. S. Brewer, J. F. Dimock, & G. F. Warner, London, 1861–91.

Gissler, Nils [1715–1771] *Beschreibung eines Fisches, Tänglake (Blennius viviparus) König.* Schwed. Akad. Abhandl., 1748, 10, 39–45. Pre-Linn. 1748.1

See note under Kästner, A. G., this section.

— *Beschreibung des Fisches Strömming in Nord-Bothnien.* König. Schwed. Akad. Abhandl., 1748, 109–141. Pre-Linn. 1748.2

See note under Kästner, A. G.

— *Beskrifning om strömmings fiskets beskaffenhet i Norrbotten.* K.

Gissler, N.

Swensk. Vetensk. Akad. Handl., 1748,
10, 107-140. Pre-Linn. 1748.3

— På tånglaken. K. Swensk. Vetensk. Akad. Handl., 1748, 10, 37-44.
Pre-Linn. 1748.4

See also *Analect. Transalp.*, 1762, 1, 485-489.
(Gissler, N., [n. d.] in vol. I.)

— Nachrichten von der Natur und Fischerey des Lachses in den Nordländischen Elben. König. Schwed. Akad. Abhandl., 1751, 13, 12-31; 99-133; 177-196; 275-290; *Ibid.*, 1752, 14, 16-28; 87-99. Pre-Linn. 1751.1

See note under Kästner, A. G.

— Rön om laxens natur och fiskande i de Norrländska alfvarna. K. Swensk. Vetensk. Acad. Handl., 1751, 11, 95; 171; 268. *Ibid.*, 1752, 11, 93.
Pre-Linn. 1751.2

— Anmärkningar om sik-fisket uti Norrländska Älfver (*Coregonus*) och skärgårdar. K. Swensk. Vetensk. Acad. Handl., 1753, 13, 195-209.
Pre-Linn. 1753.1

Glanville, Bartholomæus. See **Bartholomæus Anglicus.**

Gleditsch, Johann Gottlieb [1714-1786] *De fertilitate piscium.* Conf. Neue Anmerk. über alle Theile der Naturlehre, Kopenhagen, 1756, 3, 568.
Pre-Linn. 1756.1

— *De propagatione piscium.* Physikal. Oekon. Patriot, Hamburg, 1756, pt. 1, 295. Pre-Linn. 1756.2

— Betrachtung über die Reichthümer Gottes in dem Wasser, (ubi præcipue de stupenda copia et fertilitate piscium agitur.) Reich Natur u. Sitten, 1757, 1, 289. Pre-Linn. 1757.1

Glorez, Andr. Haus- und Land-Bibliothek. Regiomonti, 1700. fol.
Pre-Linn. 1700.1

Tome I, liber XIII, von der Fischerey, p. 393-409.

Glover, Thomas. An account of Virginia, its scituation, temperature, productions, inhabitants . . . &c. Phil. Trans. Roy. Soc., 1676, 11, 623-636.
Pre-Linn. 1676.1

References to fishes of Virginia, p. 624-625.

Glovez, Andreas. Vollständige Haus- und Landbibliothek, Jagd, Vogelfang, Fischerei, etc. Nürnberg, 1719. fol.
Pre-Linn. 1719.1

"Von der Fischerei," p. 393-409.

Göchhausen, Herm. Frid. von. *Notabilia venatoris; oder Jagd- und Weidwerksanmerkungen.* Nordhausen, 1710. 2 pl. fol. Pre-Linn. 1710.1

Other eds.: 1718; 1727; 1737; 1722; 1731; 1740; 1751; 1764.

A writer in the *Gel. Nachricht zum Hamburg Corresp.*, 1751, says that the 5th ed. contains a description of various streams and fishes.

Göritzius, Johann Adam. Von den frembden Fischen, Seelauben (*Alosa*) genannt. Bresl. Natur. Kunstgesch., 1721, 17. sec., 168. Pre-Linn. 1721.1

Götz, Frid. Leberecht. *Dissertatio de ICHTHYOLAPREIA.* Lipsiæ, 1723. 4°. Pre-Linn. 1723.1

Gomara, Francisco Lopez de [1510-1560 or 1576] *La historia general de las Indias, con todos los descubrimientos, y cosas notables que han acaescido enellas, dende que se ganeron hasta agora, escrita por Francisco Lopez de Gomaro, clerigo Añadiose de nuevo la descripcion y traca de las Indias, . . .* Anvers, 1554. 16 leaves, 287 p. sm. 8°. Pre-Linn. 1554.1

A number of contemporary Spanish editions were issued, and the book was reprinted in Spain several times during the 19th century.

There are French versions of 1568, 1584, 1587, and 1606, and an English translation of 1578. Available are:

— *Histoire générale des Indes occidentales, etc.* Paris, 1568. 8°. Pre-Linn. 1568.1

— The pleasant historie of the conquest of the Weast India [T. Nicholas trans.] London, 1578. 4°. Pre-Linn. 1578.1

Gomara records data concerning West Indian fishes and gives an account of fishing with the remora. He never visited the new world.

Googe, Barnaby (editor) [1540-1594] See note under **Heresbach, C.**, Pre-Linn., 1577.1.

Gosky, Mart. *Arbustum Augusteum.* Wolffenbüttel, 1650. figs. Pre-Linn. 1650.1

Die Fische im Herzogthum Braunschweig, p. 280 —.

Grandi, Lazaro. *Alfabetto di secreti medicinali . . . con l'arte facile d'uccallare, e pescare.* Bologna, 1667. 216 p. 8°. Pre-Linn. 1667.1

Grant, W. Auszug aus — Brief — von der Paarung und Fortpflanzung des Lachses. König. Schwed. Acad. Abhandl., 1752, 142-146. — *Uitgez. Verh.*, 4, 236-241. Pre-Linn. 1752.1

See note under Kästner, A. G., this section. See also Grant, W. Add. 1762.1.

— Utdrag af — bref — om laxens parnings och afelses sätt. K. Svensk. Vetensk. Acad. Handl., 1752, 134–138. Pre-Linn. 1752.2

Grapaldus, Francis Marius [1464–1515] *De partibus ædum*, etc. 1494. Pre-Linn. 1494.1

See Lambert, Osmund, 1883.1, for a notice of this work.

Grausius, M. Beschryvinge van de natur der viervoetige dieren, vissen en water-dieren, vogeln etc. nessen haer beeldnissen in koper gesneden uyt et latin vertaelt. Amsterdam, 1660. fol. Pre-Linn. 1660.1

Grew, Nehemiah [1641–1712] *Museum Regalis Societatis, Or a catalogue & description of the natural and artificial rarities belonging to the Royal Society and preserved at Gresham Colledge . . . Whereunto is subjoyned the comparative anatomy of stomachs and guts.* London, 1681. 386, 42 p. 31 pls. 4°. Pre-Linn. 1681.1

Of viviparous fishes, sect. i, chap. i, p. 81–103. The plates are well executed and 7 non-European fishes are described.

A 2nd ed.: 1686.

Griffiths, Roger, (Water-Bailiff). An essay to prove that the jurisdiction and conservancy of the River of Thames . . . is committed to the Lord Mayor and City of London, both in point of right and usage, by prescription, charters, etc. To which is added a brief description of those fish with their seasons, etc., that are caught in the Thames or sold in London. With some few observations on . . . fish in general. London. 1746. xx, 296 p. 8°. Pre-Linn. 1746.1

"This work appears to have been an apurtenance of the water-bailiffs, as in 1758 we find it claimed by Robert Binnell." (q. v.) — W. & S.

Copy, N. Y. P.

Grindal, William. Hawking, hunting, fouling, and fishing, with the true measures of blowing. Now newly collected by W(illiam) G(ryndall). London, 1596. 4°. Pre-Linn. 1596.1

A black letter reprint, or plagiarized edition, of the "Boke of St. Albans."

Gronovius, Johannes Fridericus [1690–1760] *Descriptio Cottus, ossiculo pinnae dorsalis primo longitudine corporis, descriptus.* Acta Reg. Soc. Sci. Upsal. 1740, 121–123. pl. 8°. Pre-Linn. 1740.1

Identified as *Callionymus lyra*.

— *Pisces Belgii, seu piscium in Belgio natantium et a se observatorum catalogus.* Acta Reg. Soc. Sci. Upsal., 1741, 67–76. — *Uitgez. Verh.*, 1757, 1, 145–159; 324–332. — Act. Helvet., 1760. (in Latin). Pre-Linn. 1741.1

— *Salmo oblongus*, maxillae inferioris apice introrsum reflexo descriptus. Acta Reg. Soc. Sci. Upsal., 1741, 85–90. Pre-Linn. 1741.2

— A method of preparing specimens of fish by drying their skins. Phil. Trans. Roy. Soc. London, 1742, 42, 57–58. — *Beytrag. Naturgesch. Mineralreiches*, 1. — *Nachr. Schles. Oekon. Ges.*, 4, 321. Pre-Linn. 1742.1

— *Pisces Belgii rariores descripti.* Acta Reg. Soc. Sci. Upsal., 1742, 79–107. pls. Pre-Linn. 1742.2

Cobitis (Mustela fossilis), *Scomber*, *Gadus (Asellus virescens)*, *Gadus (alius)*, *Blennius*, (*Mustela vivipara*), *Trachinus*, *Trigla*.

— *Piscis Scombri et Percæ descriptio.* Acta Reg. Soc. Sci. Upsal., 1744, 36–42. pl. Pre-Linn. 1744.1

— The figure of the *Mustela fossilis* [*Cobitis caerulea*]. Phil. Trans. Roy. Soc. London, 1747 (1748), 44, 451. fig. Pre-Linn. 1748.1

Gronovius, Laurentius Theodorus [1730–1778] *Museum Ichthyologicum, sistens piscium indigenorum et quorundam exoticorum, qui in Museo Laur. Theod. Gronovii, adservantur, descriptiones, ordine systematico; accedunt nonnullorum exoticorum piscium icones, æri incisæ.* 2 vols. Lugduni, 1754–56. 70, 46 p. 25 pls. fol. Pre-Linn. 1754.1

Vol. I (1754) contains the fishes.

— Beschryving van een onbekende inlansen vis *Cyclogaster* [*Cyclopterus*]. *Uitgez. Verh.*, 1757, 1, 581. 2 figs. Pre-Linn. 1757.1

— Lijst van eenige vissen van Nederland, die door den Heere J. F. Gronovius in de Acta Upsaliensia van't jaar 1741 niet angetekend zijn. *Uitgez. Verh.*, 1757, 1, 324–332. Pre-Linn. 1757.2

For later works of this author, see Gronovius, L. T. in vol. I.

Gronow. See **Gronovius**.

Grundig, C. G. *Neue Versuche nützlicher Sammlungen zur der Natur- und Kunstgeschichte, sonderlich von Ober-*

Grundig, C. G.

sachsen. 4 vols. Schneeberg, 1750-65.
8°. Pre-Linn. 1750.1

Gründlicher Bericht von der Zucht, Ver-
setzung und Wartung der Karpfen.
Fossil fishes, vol. I, p. 463, 567.

Guenelloni, —. Excerpta ex epis-
tola ad Charletonu, anatomian oculi
[Gadus] concernentia. Nouv. Reipub.
Litt. Amstelodami, 1686, 8. fig. —
Act. Erudit, [1686], 5, 139.
Pre-Linn. 1686.1

Guicciardini, Luigi [1523-1589] Bel-
gium, dat is: Nederlandt, ofte beschry-
vinge derselviger provincien ende steden.
Amstelodami, 1648. figs. maps. fol.
Pre-Linn. 1648.1

"Visschen van de Mase, p. 13; van de Schelde,
p. 14. Haringhen, cabeljau, salmen, steuren,
p. 20-21. Grousame visschen, p. 264." — Bos-
goed.

Other eds.: 1st., Antwerp, 1567 (in French &
Italian); 1580 & 1588 (both in Dutch); Basel,
1580 (German); & Amsterdam, 1613 (Latin).

Gumilla, Joseph [c. 1690-1758] El
Orinoco ilustrado, y defendido, historia
natural, civil, y geographica de este gran
rio, y de sus caudolosos vertientes: . . .
con nuevas, y utiles noticias de ani-
males, arboles, fiutos aceytes, refinaz,
yervas, y raices medicinales; . . . &c.
2 vols. Madrid, 1741. 24, 403 p. pl.
map. 4°. Pre-Linn. 1741.1

"Variedad de peces, y singulares industrias
de los Indios para pescar: Piedras y buessos me-

dicinales, que se han descubierto en algunos pes-
cados," — tome II, cap. XXI, p. 314-330.

The 1st ed.; 2nd (title unchanged), Madrid,
1745. A French version of the latter is entitled:

— Histoire naturelle, civile et géo-
graphique de l'Orénoque. . . . Dans la-
quelle on traite . . . des animaux, des
arbres des fruits, des résines, des herbes
& des racines medicinales qui naissent
dans le pais . . . &c. 3 vols. Avignon
& Marseilles, 1758. 383, 334, 332 p.
pls. map. 12°. Pre-Linn. 1758.1

"Poissons de l'Orénoque. Moyens indus-
trieux dont les Indiens se servent pour les
prendre. Vertus medicinales des pierres & des
os qu'on trouve dans quelques uns," — tome II,
chap. XXI, pp. 36-58.

A later Spanish edition has the following
title:

Historia natural, civil y geografica de las na-
ciones situadas en las riveras del Rio Orinoco.
Su autor el Padre Joseph Gumilla, . . . Nueva
impresion: Mucho mas correcta que las ante-
riores, y adornada con ocho láminas finas, . . .
Corregido por el P. Ignacio Obregón, de las Clé-
rigos Menores: 2 vols. Barcelona, 1791.

Variedad de peces, y singulares industrias de
los Indios para pescar, vol. I, p. 277-292. Peces
ponzoñosos y sangrientos, vol. II, p. 204-214.

A present day reprint is said to have been is-
sued Barcelona, 1882, but has not been seen.

Guyot, —, & Pajot, —. [On a
method of preserving fishes in their
natural colors]. Mercure de France,
1749. Pre-Linn. 1749.1

Gyllius, Petrus. See Gilles, Pierre.

H

H., R. The school of recreation: or the gentlemans tutor to those most ingenious exercises of hunting, racing, hawking, . . . fishing, etc. London, 1684. 202 p. 12°. Pre-Linn. 1684.1

Sometimes (doubtfully) attributed to R. Howlett.

Often reprinted: London, 1696, 1701 (a paginary reprint), 1710, 1719, 1720, 1732, 1736, 1784.

Haecken, Arnold van. Eight plates from pictures in Fishmonger's Hall in London, containing the fish brought to the London market. Painted from the life by A. van Haecken, engraved by G. King and A. Jongelincx. London, 1734. fol. Pre-Linn. 1734.1

Another edition, having a frontispiece recording "The view and humors of Billingsgate," appeared in 1736.

Hagen, J. L. Landwirthschaftliche Teich- und Weiherlust, oder gründliche Information zur edlen Fischerei. Frankfurt, 1727. 8°. Pre-Linn. 1727.1

Hahn, Justinus. Conclusiones juridicae de jure colonario si perpetuae coloniae piscandi, venandi, aucupandi. Helmstadtii, 1678. 4°. Pre-Linn. 1678.1

Hain, John Paterson. De cochlea in capite lucii reperta. Ephemer. Acad. Nat. Cur., 1671, dec. 1, ann. 2, obs. 115, p. 192. Pre-Linn. 1671.1

Hale, Thomas (editor) A compleat body of husbandry, containing rules for performing in the most profitable manner the whole business of the farmer and country gentleman . . . London, 1756. iv, 719 p. illust. fol. Pre-Linn. 1756.1

Chapters XLII-XLV in book v, vol. II, of this ed., making and stocking fish-ponds, feeding, preserving, and rearing fish.

2nd ed., 4 vols. London, 1758. (See Hale, T. 1758.1)

Hales, Stephen [1677-1761] An account of some trials to keep water and fish sweet with lime-water. Phil. Trans. Roy. Soc. London, 1753-54 (1754), 48, 826-831. — Wittenberg. Wochenbl. 1770, 102. Pre-Linn. 1754.1

Haller, Albrecht von [1708-1777] For memoir with portrait, see Swainson, W.

(In Jardine, Sir William The Naturalist's Library. 1862, vol. XIII.)

— Auszug aus einem Schreiben Herrn Grants von der Paarung und Fortpflanzung des Lachses. König. Schwed. Akad. Abhandl., 1752, 14. Pre-Linn. 1752.1

See note under Kästner, A. G.

— Om laxens parnings- och afläggssätt. K. Svensk. Vetensk. Akad. Handl., 1752, 134. Pre-Linn. 1752.2

— Observation sur le pénis des saumons. Mém. Acad. Sci. Paris, 1753, hist., 136-137. Pre-Linn. 1753.1

For later works of this author, see Haller, Albert von, in vol. I.

Hamberger, Georg Erhard [1697-1755] Programma 1. 2. 3. 4. 5. de Cyprino monstroso rostrata. Jenæ, 1748. 8 p. pl. 4°. Pre-Linn. 1748.1

Hannaeus, George. *Xiphias adumbratus*. Ephemer. Acad. Nat. Cur., 1689 (1690), dec. 2, an. 8, observ. 107, 241-243. Pre-Linn. 1690.1

Hannemann, Bartholomæus Johann Otto. De passere pisce grandinoso [Goldbutten]. Misc. Acad. Nat. Cur., 1697, 3. dec. 5. *Ibid.*, 1698, 6, 462. Pre-Linn. 1698.1

Hannemann, Johann Ludwig (*præses*) [1640-1724] Dissertatio de pisce torpedine ejusque proprietatibus admirandis exhibens. Inaug. Dissert. Kiloni, 1710. 18 p. 4°. Pre-Linn. 1710.1

Abia Georg Cramer, respond.

Hannemann, Peter Johann Chstn. Friederich. De articulatione ossium singulari in spina piscis Americani, cujus ginglymus est concatenatus. Ephemer. Acad. Nat. Cur., 1695-96, 2. dec. ann. 3, p. 80. Pre-Linn. 1695.1

Hanow, Michel Christopher [1695-1773] For some account of his work, and for a portrait, see Schumann, E. "Geschichte der naturforschenden Gesellschaft in Danzig, 1743-1892." Festschrift zur Feier des 150-jährlicher Bestehens der naturforschenden Gesellschaft in Danzig. 1893. 8°.

Hanow, M. C.

— Erlauterte Merkwürdigkeiten der Natur. 3 vols. Danzig, 1737. 4°. Pre-Linn. 1737.1

- i. Anmerkungen über die Blasen der Fische. 1, 610.
- ii. Beschreibung eines Meerochens. 1, 479 & 648.
- iii. Einige berechnete Fischrogen. 1, 607.
- iv. Von einem gestrandeten Schwerdtfische. 1, 468; 3, 122.
- v. Von einem unerhörten Winterfischzuge, wo zugleich von den Plötzen gehandelt wird. 1, 596.
- vi. Von den Augen der Flunder auf der linken Seite. 3, 141.
- vii. Von einem schwangeren Birgsroger [Percal]. 3, 142.
- viii. Von fremden giftigen Fischstacheln. 3, 130.
- ix. Von jungen Haifischen. 3, 115.

— Seltenheiten der Natur und Oeconomie, nebst deren kurzen Beschreibungen und Erörter; aus den Danziger Erfahrungen und Nachrichten gezogen und herausgegeben von J. D. Titius. 3 vols. Leipzig, 1753–55. 6 pls. 8°. Pre-Linn. 1753.1

Apparently an edition of the above work.

Hardt, Herm. van der. Jonas in carcharia. Helmstadt, 1718. 8°. Pre-Linn. 1718.1

— Ænigma Tobixæ cum grandi pisce. Helmstadt, 1719. 4°. Pre-Linn. 1719.1

Hartenfels, George Christopher Petrus ab. Programma de piscatu. Erfurt, 1691. 4°. Pre-Linn. 1691.1

Hartenstein, J. F. See **Hertenstein, J. F.**

Hartmann, Philipp Jacob [1648–1707] Descriptio anatomica Siluri ventriculi. Misc. Acad. Nat. Cur., 1688 (1689), 2. dec., ann. 7, 80–83.

Pre-Linn. 1688.1

Reprinted in Valentini, M. B. "Amphitheatrum Zootomicum," Francofurti, 1720, pt. II, 101–102.

— [De diverticulo intestinorum in salmone.] Ephemer. Acad. Nat. Cur., 1689, exerc. 1. Pre-Linn. 1689.1

— (*præses*) Disquisitio de Xiphia sive Gladio. Regiomonti, 1693. 22 p. 4°. Pre-Linn. 1693.1

Joh. Faber, *respond.*

— Descriptio anatomico-physica Xiphixæ sive Gladii piscis. Ephemer. Acad. Nat. Cur., 1694 (1695), 3. dec., ann. 2, append., 1–22. Pre-Linn. 1695.1

Hartung, Valent. De halecum [Harengus] esu et usu. Leipzig, 1615. 4°. Pre-Linn. 1615.1

Hasselquist, Frederick [1722–1752] Iter Palæstinum, eller resa til Heliga Landet förrättad inifrån år 1749 til 1752, med beskrifningar, rön, anmärkningar, öfver de märkvärdigaste naturalier, på Hennes Kongl. Maj. 'ts befallning utgifven af Carl Linnæus. Stockholm, 1757. xiv, 619 p. 8°.

Pre-Linn. 1757.1

Fishes, p. 324–407.

Post-Linnæan translations are:

Reise nach Palästina in dem Jahren 1749 bis 1762. Herausgegeben von C. Linnæus. Aus dem Schwedischen [übersetzt von T. H. Gadebuschl. Rostock, 1762. xviii, 606 p. 8°.

Voyages and travels in the Levant in . . . 1749–52; containing observations in natural history, physick, agriculture and commerce. . . London, 1766. viii, 456 p. map. 8°.

Voyage dans le Levant, etc. Paris, 1769. 8°.

Hauksbee, Francis [1687–1763] An account of some experiments touching the keeping of fishes in water under different circumstances. Phil. Trans. Roy. Soc. London, 1712, 27, 431–434.

Pre-Linn. 1712.1

In boiled water and in water *in vacuo*.

Hawkins, (Sir) Richard [1562?–1622] For a biographical notice, see Barnett, John. "Sir Richard Hawkins, the complete seaman." Cornhill Mag., 1910, 28, 535.

— The observations of Sir Richard Hawkins, Knight, in his voyage to the South Sea, Anno Domini, 1593. London, 1622. Pre-Linn. 1622.1

Habits of dolphin, 66–67; bonito, 68; shark, voracity and receiving young in mouth, 68–70; flying fish, 70; swordfish and thresher fighting whale, 71–72.

A modern reprint in Hakluyt Soc. Works, London, 1847, no. 1. Another reprint, along with voyages of William and Sir John Hawkins, in Works, 1878, no. 57.

Haydenpuecher, Jo. Ge. (respond.) Disputatio de iure venandi, aucupandi et piscandi. (In Mor de Nigromonte, G. Pre-Linn. 1602.1, p. 128–144)

Pre-Linn. 1602.1

D. Hier. Rath, *præses*.

Hebenstreit, Johann Ernst [1703–1757] De collectione piscium Africanorum, pro ed. ac herbaria viva convinari solent modo parata. Comm. Litt. Norimbergæ, 1733, 35.

Pre-Linn. 1733.1

— De organis piscium externis. Inaug. Dissert. Lipsiæ, 1733. 20 p. figs. 4°. Pre-Linn. 1733.2

Reviewed in Comm. Litt. Norimbergæ, 1733, 409, and *Ibid.*, 1734, 61.

Copy, A. M. N. H.

Heger, Johan Ludwig. Landwirthschaftliche Teich- und Weyher-Lust, oder gründliche Information zur edlen Fischerei, etc. Frankfurt & Leipzig, 1727. xx, 135 p. 8°. Pre-Linn. 1727.1

Heins, Martin (*præses*) Analysis exercitationes 225. J. C. Scaligeri ad Cardanum de piscium habitaculis et allēlophagia, seu mutuâ Laniens. Inaug. Dissert. Wittebergæ, 1639. 4°. Pre-Linn. 1639.1

Thomas Saurmann, *respond.*

Hellant, Andreas [—1789] (*respond.*) Dissertatio de novo in fluviis Norlandiarum piscandi modo. Om et nyt sät at fiska i Norländska elfwar. Inaug. Dissert. Upsaliæ, 1738. 28 p. pl. 4°. Pre-Linn. 1738.1

A. Celsius, *præses*. Copy, N. Y. P.

— Berättelse om laxens alstrande, i åkt tagit vid des fiskande. K. Svensk. Vetensk. Acad. Handl., 1745, 267. Pre-Linn. 1745.1

— Bericht von Erzeugung des Lachses, wie solche bey seine Fischerey ist beobachtet worden. König. Schwed. Akad. Abhandl., 1745, 7, 271–283. Pre-Linn. 1745.2

See note under Kästner, A. G. See also Hellant, A., Add. 1762.1.

Heller, Johann. Neues Jag und Weydwerck-Buch, das ist, ein gründliche Beschreibung vom Anfang der Jagten. Neu vom adelichen Weydwerk der Falcknerey, Beyssen und Federspiel; dergleichen vom Fischfangen. Frankfurt-am-Mayn, 1582. fol. Pre-Linn. 1582.1

Helmont, Jean Baptiste van [1577–1644] Opera omnia, etc. Francofurti, 1707. 8°. Pre-Linn. 1707.1

Numerous incidental references to fishes in medicine. Book well indexed.

An earlier ed.: Frankfort, 1682.

Helsing, Joh. (*præses*) Dissertatio de carne piscium. Hafniæ, 1714. 8 p. 4°. Pre-Linn. 1714.1

Chr. Lehman, *respond.*

Helvig, or Helwing, Christopher (*præses*) [1679–1714] Dissertatio specimen pharmacologiæ sacræ de antimonio, cicuta et pisce Tobiaë sive siluro. Gryphiswaldiæ, 1708. 34 p. 4°. Pre-Linn. 1708.1

E. G. von Seelen, *respond.*

Helwing, Georg Andreas [1666–1748] Lithographia Angerburgica sive lapidum & fossilium in districtu Angerburgensi

& ejus vicinia ad trium vel quatuor miliarii spatium in montibus, agris, arenofodinis & imprimis circa lacuum littora & fluviorum ripas collectorum brevis & succincta consideratio. 2 vols. (in 1) Regiomonti, 1717–20. 96, 132 p. 6 pls. 4°. Pre-Linn. 1717.1

Glossopetras, p. 59–60.

— Eigentliche Nachricht von der sogenannten Blau-Asche (Thymallus) im Preussen. Samml. Natur u. Med., Kunst u. Litt.-Gesch., Breslau, 1718, 1391. Pre-Linn. 1718.1

Henchelin, Caspar (*respond.*) Disputatio de domino proprietatis et ejus acquirendi modus . . . et quidem de venatione, piscatione et inventione. Inaug. Dissert. Tubingiæ, 1599. 4°. Pre-Linn. 1599.1

Henricus Bocer, *præses*.

Henelius, Nicol. Silesiographia renovata. 2 vols. Wratislaviæ (Breslau), 1704. 4°. Pre-Linn. 1704.1

Fishes of Silesia described.

Hennike, J. C. Nachricht von einer besondern Fischkrankheit. Frankisch. Samml., Nürnberg, 1756, 2. 23 p. Pre-Linn. 1756.1

Heppe, C. Wilh. von. Der in denen, bey dem Forstjagdwesen und der Fischerey vorkommenden Fällen sich selbst rathende Jäger. Augspurg, 1753. 8°. Pre-Linn. 1753.1

Another ed.: Augspurg, 1763.

— Der sich selbst rathende Jäger, oder 117 auserlesene, zum Theil sehr delicate Casus und streitige Fälle, welche bei dem Forst-, Jagd- und Fischerey-Wesen vorkommen. Augsburg, 1754. 8°. Pre-Linn. 1754.1

Heresbach, Conrad [1509–1576] Rei rusticæ libri quatuor . . . Thereutices, hoc est, de venatione, aucupio atque piscatione compendium. Coloniae, 1570. 4°. Pre-Linn. 1570.1

Conrad Heresbach is one of the old farmers discussed by Donald G. Mitchell, in his "Wet days at Edgewood." (1865.1) His book as a whole, and particularly those parts relating to fish and fishing, were often reprinted. The most notable editions will be given by titles and others by years. Bosgoed lists an ed., Coloniae, 1571 in 8°. The next ed. seems to be:

— Rei rusticæ libri iv universam rusticam disciplinam complectens. Item de venatione, aucupio atque piscatione compendium. Coloniae, 1573. vii, 713, 12 p. Pre-Linn. 1573.1

Fishes, pp. 690–713.

Other Latin eds.: Cologne, 1594, 1595, 1603. The first English version is:

Heresbach, C.

— Four bookes of husbandry, collected by M. Conradus Heresbachius, Counsellor to the hygh and mighty Prince, the Duke of Cleve; conteyning the whole arte and trade of husbandry, with the antiquitie and commendation thereof. Newly Englished, and increased by Barnabe Googe, Esquire. London, 1577. iv, 193 p. 4°.

Pre-Linn. 1577.1

Other English eds., or more probably reprints, are: London, 1578, 1586, 1594, 1596, 1600, 1601, 1604. Next comes Googe's enlarged ed. of 1614, "The whole art and trade of husbandry," etc. followed by Gervase Markham's greatly augmented version of 1631. Copies, 1570 (Latin), & 1614 (English) eds., N. Y. P.

— The whole art of husbandry contained in foure bookes, etc. Booke iv. Of poultrie, fowle, fish . . . and the art of angling . . . now renewed, corrected, enlarged and adorned with all the experiments and practises of our English nation, which were wanting in the former editions. By Captaine Garvase Markham. London, 1631. 4°. Pre-Linn. 1631.1

— Libri quarti de re rustica pars quæ agit de piscinis et piscium vivariis. Ejusdem thereutices pars tertia de piscatione. Helmstadt, 1657. 4°.

Pre-Linn. 1657.1

The editor, Hermann Conringius, has here brought together the matter relating to fishing and fishponds contained in "De re rustica" and the "Thereutices." For a modern English version of "De piscatione," which aims at "rendering as nearly as possible the style and colour of the epoch," with a brief introduction by T. Westwood, see "The angler's notebook and naturalists' record," etc., pp. 117, 133, 149, 165. London, 1880.

The most famous English ed. is:

— The perfect husbandman, or the art of husbandry. In four books . . . Book iv. Of poultry, fowle, fish and bees with the . . . art of angling. By C. H., B. C., and C. M., ingenious artists. London, 1658. vi, 385 p. 4°. Pre-Linn. 1658.1

Hérissant, François David [1714–1773] *Recherches sur les usages du grand nombre de dents du Canis carcharias*. Mém. Acad. Sci. Paris, 1749 (1753), 155–162. 3 pls. — Comment. Lips., 1754, 3, 477. Pre-Linn. 1753.1

Herlein, J. D. *Beschryvinge van de volk-plantinge Suriname; vertonende de opkomst dier zelve colonie, etc. Mitsgaders een verhoog . . . van de water- en pluimgediertens*. Leeuwarden, 1718. pls. 4°. Pre-Linn. 1718.1

Visschen en zeegedrochten, p. 193–201.

Hernandez, Francisco [1514–1578]

For a notice of this author (who was physician to Philip II) and of his writings, see Rich, O. "A catalogue of books relating principally to America 1493–1700." London, 1832. pp. 72–74. Also Sabin, J. "Bibliotheca Americana," vol. VIII, pp. 239–241 (1868.1), and Lichtenstein, M. C. H., in *Abhand. Akad. Wiss. Berlin*, 1827, 88–127.

— *Quatro libros de la naturaleza y virtutes de las plantas y animales, que estan recevidos en el uso de medicina en la Nueva España y el metodo y correccion y preparacion, que para administrallas se requiere, con lo que Francisco Hernandez escrivio en lengua latina. . . . Traducido y aumentados muchos simples y compuestos y ochos muchos secretos curativos por Fr. Francisco Ximenez*. Mexico, 1615. 4°. 203 p. Pre-Linn. 1615.1

A modern reprint of this is:

Cuatro libros de la naturaleza y virtudes medicinales de las plantas y animales de la Nuevo España. Extracto de las obras del Dr. F. Hernandez. Anotados, traducidos y publicados en Mexico el año de 1615 por Fr. Francisco Ximenes . . . Ahora por primera vez reimpresso . . . bajo la direccion del Dr. N. León. Morelia, 1888. lii, 300 p. pl. 8°.

— *Rerum medicarum Novæ Hispaniæ seu thesaurus, plantarum, animalium, mineralium Mexicanorum historia ex Francisci Hernandi Novi Orbis medici primarii relationibus in ipsa Mexicana urbe conscriptis à Nardo Antonio Reccho . . . Collecta notis illustrata; cum indice, et historiæ animalium et mineralium libro*. Romæ, 1628. 950 p. Pre-Linn. 1628.1

This is the first ed. of Recchus' Latin version. Others are: Rome, 1641, 1648–49, 1651. There is said to be an earlier Latin translation, Rome, 1626, editor not known. The most valued edition of all is:

— *Nova plantarum animalium et mineralium Mexicanorum historia a Francisco Hernandez medico. In Indiis præstantissimo primum compilata, deinde a Nardo Antonio Reccho in volumen digesta, a Io. Terentio, Io. Fabio, et Fabio Columna Lynceis notis, & additionibus longe doctissimis illustrata. Cui demum accessere aliquot ex principis Federici Cæsii frontispiciis theatri naturalis philosophicæ tabulæ una cum quam plurimis iconibus, ad octingentas, quibus singula contemplanda graphice exhibentur*. Romæ, 1651. Pre-Linn. 1651.1

Fishes, folios 76–88.

Hernandez prepared 16 folio volumes on

the plants, animals and minerals of Mexico. An edition of the "Opera" (most parts hitherto unpublished) was begun at Madrid, 1790, but got no further than the issuing of "De historia plantarum," etc.

Herodotus [c. 484-425 B. C.] For a sketch of his life and a commentary on his works, together with bibliographical details about their publication, see article in *Encyclopædia Britannica*, vol. XIII, 11. ed., 1910, by George Rawlinson & E. M. Walker.

— *Historiæ*. Venice, 1474. fol.
Pre-Linn. 1474.1

Other early eds. are: Rome, 1475; & Venice, 1494 & 1502. Copies of these in H., Y., Col., & L. C.

An English translation of books I & II of the "Historiæ" was published in London, 1584, but the first complete English version is:

— The Aegyptian and Grecian history of Herodotus, translated from the Greek by Isaac Littlebury. 2 vols. London, 1709. Pre-Linn. 1709.1

2nd & 3rd English eds. are: London, 1723 & 1737.

Editions in various languages have appeared, too numerous to mention. The history of Herodotus is most available for present day English readers in the 4 vol. edition by George Rawlinson, New York, 1866. The references below apply, however, to any edition.

Ichthyophagi: Babylonian, book I, chap. 200; of the Nile, book II, chap. 77; of Elephantia, book III, chap. 77. Fishes of the Nile, book II, chap. 77. Habits of Nile fishes, *Ibid.*, chap. 93. Fishes in Lake Moeris, *Ibid.*, chap. 149. Fishes of Lake Prasias in Pæonin fed to horses, book V, chap. 17. Herodotus is said to refer to fossil fishes of Mt. Lebanon, but this has not been confirmed.

Herrera y Tordesillas, Antonio [1549-1625] *Historia general de los hechos de los Castellanos en las islas y tierra firme del Mar Oceano*. 4 vols. Madrid, 1601-15. fol.

Pre-Linn. 1601.1

Contains accounts of the fishes of the West Indies and of fishing with the remora.

Various translations & editions follow.

— *Description des Indes Occidentales, qu'on appelle aujourd'hui le Nouveau Monde*, etc. Amsterdam, 1622. fol.

Pre-Linn. 1622.1

— *Nieuwe Werelt, anders ghe-naempt West-Indien*. Amsterdam 1622. fol.

Pre-Linn. 1622.2

— *Novus orbis, sive descriptio Indiæ occidentalis, metaphraste G. Barlæo*, etc. Amstelodami, 1622. fol.

Pre-Linn. 1622.3

— *Beschreibung dero Insulen und dess festen Lendes Jenseit dess hohen*

grossen Meers, so man nennt West Indien (In De Bry. *America*. Pt. XII. — German. *Zwölffter Theil der neuen Welt*. 1623. fol.) Pre-Linn. 1623.1

— The general history of the vast continent and islands of America, commonly called the West Indies, from the first discovery thereof: with the best account the people could give of their antiquities. Translated by Capt. John Stevens. 6 vols. London, 1725-26. maps. cuts. 8°. Pre-Linn. 1725.1

Other eds. are: Amsterdam, 1622 (Latin); Paris, 1660 & 1671; Antwerp, 1728; Amberg, 1728; Madrid, 1726 & 1729-30; London, 1745. Found also in Churchill's "Collection of Voyages," vol. V, 1732; and in Kerr's "Voyages and Travels," vols. III & V, 1824.

Herrera's account of Orellano's descent of the river Amazon, 1540-41, from the 6th decade of his "Historia general," has been translated and edited by Markham in Hakluyt Soc., Works no. 24, 1859. Fishes, sec. xxv of this.

Hertenstein, Johannes Fridericus (*prases*) *Dissertatio de magno pisce, qui Jonam vatem deglutivit*. Wittembergæ, 1705. 2 pl. 4°. Abstract in *Nouv. Liter. German.* Hamburg, 1705, 447. Pre-Linn. 1705.1

"Carchariam fuisse asserit." Kirchmaier, *respond.*

Hextor, J. van, & Nylant, P. See **Nylant & Hextor**.

Heyke, Dellof. *Fische die in Austerschalen gefunden worden* (Ophidium). *König. Schwed. Akad. Abhandl.*, 1744, 6, 116-117. Pre-Linn. 1744.1

See note under Kästner, A. G., Pre-Linn.

— *Om fiskar* (Ophidium) *funna i Ostronskal*. *K. Svensk. Vetensk. Acad. Handl.*, 1744, 6, 116-117.

Pre-Linn. 1744.2

Higginson, Francis [1587-1630] *New England's plantation; or, a short and true description of the commodities and discommodities of that countrey*. Written by a reverend divine now there resident. London, 1630. 11 leaves. 4°. Pre-Linn. 1630.1

The 8th leaf has the following caption: "Of the waters of New England with the things belonging to the same." This gives an account of the fish and their abundance.

Reprinted in Force's *Historical Tracts*, 1, tract 12. Also in *Coll. Mass. Hist. Soc.* 1792 (1806), 1, Extracts in *Rept. U. S. Fish. Comm.* 1871-72 (1873), 159-160.

Hildebrand, Wolfgang. *Neue augirte . . . viel vermehrte Magia Naturalis. Dass ist Kunst und Wunderbuch, darinnen begriffen . . . wie man nemlich mit . . . Fischen . . . ver-*

Hildebrand, W.

richten . . . und zu Nutz gebrauchen und damit die Zeit vertreiben kan, etc. Erfurt, 1664. 4°. Pre-Linn. 1664.1

Hildegarde de Pinguia (also styled **Saint Hildegard**. Abbess of Bingen) [c. 1098–1179] For accounts of the life and natural history observations of this remarkable personage, see Jessen, Carl. "Ausgabe der Hss. der medic.-naturhistor. Werke der heiligen Hildegard." Sitzber. Akad. Wiss. Wien, mat.-naturw. Kl., 1862, 45, 1. Abth., 97–116; and Mozans, H. J. "Women in Science." New York, 1913, 232–235. Also Geisenheyner, L. 1911.1; Kaiser, P. 1901.1; Reuss, F. A. 1835.1; Wasmann, E. 1913.1 & 1913.2; Fischer-Benzon, R. van. Add. 1895.1.

— *Physica S. Hildegardis elementorum, fluminum aliquot Germaniæ, metallorum, leguminum, fructuum et herbarum, arborum et arbustorum, piscium, denique, volatilium et animantium terræ naturas et operationes, libris iv, mirabili experientiâ posteritati tradens. Argentorati (Strasburg), 1533. fol.* Pre-Linn. 1533.1

This is the *editio princeps*.

Another ed. of the same year bears the title:

— *Physica elementorum sanctæ Hildegardis, sive subtilitatum diversarum naturarum creaturarum libri ix. Argentorati, 1533. fol.*

Pre-Linn. 1533.2

— *Hortus sanitatis, quatuor libris quæ subsequuntur complectens; de animalibus & reptilibus; de avibus & volatilibus; de piscibus & natatilibus; de gemmis & in venis terræ nascentibus. Argentorati, 1536. fol.*

Pre-Linn. 1536.1

"Conspectum hujus editionis vide apud Urb. Frid. Bened. Bruckmannum in libello cui titulus est Untersuchung ob dem Frauenzimmer erlaubt sei, die arzeneykunst aus zu üben." Title and comment from Gronovius.

— *Titulo physicæ cum Georg. Kraut experimentario medicinæ. Argentorati, 1544. fol.* Pre-Linn. 1544.1

This is a revision by Kraut of the earlier book. Kraut also published at Argentorati in 1544 under his own name another book based on the work of Hildegarde.

For a present day edition of this work of Hildegarde, see:

Reuss, F. A. "Der heiligen Hildegard subtilitatum divers. naturarum creaturarum libri ix." 1859.

Another modern reprint is in Migne, J. P. "Patrologia latina." Paris, 1855, vol. CXCVII. It is also found in editions of her collected works by Migne and by Pitra, both Paris, 1882.

"Wir besitzen aus der ganzen Zeit vor Albertus kein Werk von solcher Bedeutung für Deutschlands älteste Naturgeschichte wie die *Physica Hildegardis vom Bingen*." Jessen.

Hill, (Sir) John [1716–1775] A general natural history; or new and accurate descriptions of the animals, vegetables and minerals of the different parts of the world, etc. 3 vols. London, 1748–52. 56 pls.

Pre-Linn. 1748.1

Published also as 3 separate volumes. Vol. I, bears the following sub-title:

— The history of fossils. 1748. 11 pls. Pre-Linn. 1748.2

Pl. viii. Fossil teeth, palates, vertebræ and whole fishes.

Vol. III is entitled:

— An history of animals; containing descriptions of the birds, beasts, fishes and insects of the several parts of the world. . . . In these the characters, qualities, and forms of the several creatures are described, the names by which they are commonly known, as well as those by which authors who have written on the subject have called them are explained. London, 1752. iv, 584 p. 27 col. pls.

Pre-Linn. 1752.1

Class v. Fishes. p. 201–318.

Another ed. of the 3rd volume, London, 1773.

For a later ed. of the "General Natural History," see Hill, John. 1771.1.

Hippocrates [B. C. 460–375 or 377] For a biography, see Fabricius, Johann Albrecht. "Bibliotheca Græca," 1705–1728, vol. XII, p. 675. Also *Encyclopædia Britannica*, 1910, XIII, 517–518. For discussions of the zoological features of the work of Hippocrates, see Burckhardt, R., 1904.1, & Eastman, C. R., 1906.2. For an account of the various editions of his "Opera," see Fischer, Joh. Henr. "De Hippocrate, eius scriptis eorumque editionibus." Coburgi, 1777.

— *Opera omnia. Venetiæ, 1526. fol.* Pre-Linn. 1526.1

Editio princeps in Greek. No separate Pre-Linnæan ed. of the "Regimen" has been found. Other early Greek eds. of the "Opera" are: Basel, 1538, & Venice, 1588 (Greek and Latin) fol. Other early eds. (presumably in Latin): Frankfort, 1595, 1621, 1624; Leyden, 1643 & 1665.

For modern versions of the "Regimen," see:

Koraes, N. "[On regimen] Notes sur le traité du régime dans les maladies aiguës et de l'ancienne médecine d'Hippocrate." Athens, 1887.

Kühn, (editor), "On regimen, books i-iv. (In *Corpus hippocraticum*. 1826–27)"

The 87 treatises forming the so-called Hippocratic collection on regimen have also been edited by Ermerius, 1859-65, and by Littré, 1839-61 (with translation). The treatise "On regimen" is doubtfully by the great physician of Kos, nevertheless it embodies what has been called the Koan system of zoological classification. In book II, fifty-two species of animals are enumerated, seventeen of which are fishes.

Högström, Pehr [1714-1784] Beschreibung des schwedischen Laplands. (In Ehrenmalm, Arvid. Reise durch Westnordland nach der Lapmark. Kopenhagen, 1748. pls. 8°.)

Pre-Linn. 1748.1

Also in Arkstee & Merkus. "Allgemeine Historie der Reisen, etc." 1771, vol. XX. Contains some notes on fishes.

Hövel, Heinr. von. Neuwer wunderbarer Thiergarten: in welchem der Unvernünftigen Irdischen Gethieren, auch der Vögeln und Fischen Natur und Eygenschaften beschrieben etc. 3 parts. Franckfurt-a.-M., 1601, 469 p. 19 Holzschn. 4°. Pre-Linn. 1601.1

Second ed.: Franckfurt, 1613. 4°.

Hoffmann, Moritz [c.1622-1698] *Mustela piscis* (Aalruppen, Quappen) [*Lota vulgaris*] anatomice examinata. Ephemer. Acad. Nat. Cur., 1722, cent. 9 & 10, 449-450. figs. — Act. Erudit., 1723, 143. Pre-Linn. 1722.1

Hohberg, Wolff Helmhard von. Georgica curiosa aucta, das ist: unständlicher Bericht und klarer Unterricht von dem adelichen Land- und Feld-Leben auf alle in Deutschland üblichen Land- und Haus-Wirtschaften 3 vols. Nürnberg, 1701. fol.

Pre-Linn. 1701.1

Reprinted in 1716.

"A very curious work with 317 fine engravings in the text. It is a complete encyclopædia of 17th century rural life in Germany." — W. & S.

According to J. Wimmer, in his "Geschichte des deutschen Bodens," this work treats extensively of fishes of the Danube and northeast Germany in the 17th century.

Bosgoed lists it under Hochberg. — Freiherr von.

Holst, Georg. En liden artig og konstig fiskebog om adskillige fiskefang, etc. Hafniæ, 1649. 4°. Pre-Linn. 1649.1

Translated from the German.

Homer [c. 11th or 10th Cent. B. C.] For critical comments on Homer and his poems, together with a list of the best modern eds., see article by D. B. Monroe in Encyclopædia Britannica (11th ed.), 1910, vol. XIII. For notes on the animals of the Iliad and Odyssey, see Groshans, G. P. 1846.1; Kums, A.

1897.1; MacDonald, W. B. 1846.1; & Moulé, L. 1909.1.

— Opera (Iliad & Odyssey). Florence, 1488. Pre-Linn. 1488.1

The *editio princeps*. Other early and valuable eds.: Venice, 1504 & 1517. No others will be listed. A bibliography of Homer would fill several volumes.

The references to fish (eel & shark) and fishing in Homer are the earliest known in literature: — Iliad, xvi, 406 & 745; xxi, 352 (eels & other fish in river Xanthus), & 692; xxiv, 80; Odyssey, v, 432; xii, 251 & 331; xix, 113; xxii, 383; xxiv, 418.

Hooge, Romein de [fl.1662-1688] Les Indes Orientales & Occidentales, & autres lieux; représentés en très belles figures, qui montrent au naturel . . . poissons, etc. Leiden, [c. 1680]. 48 pls. obl. 4°. Pre-Linn. 1680.1

Descriptions in French and Dutch. Hooge was a Dutch engraver. His work is preserved in the British Museum.

Hooke, Robert [1635-1703] Micrographia or some physiological descriptions of minute bodies made by magnifying glasses, with observations and inquiries there upon. London, 1665, 34, 246 p. 38 pls. sm. fol. Pre-Linn. 1665.1

Scales of fishes, p. 162.

Horrebow, Niels [1712-1760] Tilforladelige Efterretninger om Island. Kiøbenhavn, 1752. 8°. Pre-Linn. 1752.1

The 1st ed. Various versions follow.

— Description physique, historique . . . d'Island. Copenhagen, 1752. Pre-Linn. 1752.2

Another French edition, 2 vols.: Paris, 1764. 12°.

— Zwerlässige Nachrichten von Island, aus dem Dänischen übersetzt. Copenhagen & Leipzig, 1753. map. 8°. Pre-Linn. 1753.1

— De tegenwoordige staat of omstandige beschrijving van het groot eyland IJsland. Bevattende . . . een omstandig bericht van de visschen, de vischvangst, toebereiden en drogen der visschen. Amsterdam, 1754. 4°. Pre-Linn. 1754.1

Herring and cod; catching, preparation of, etc., pp. 48-64.

— The natural history of Iceland: containing a particular and accurate account of the . . . fishes, &c. London, 1758. xx, 207 p. map. fol. Pre-Linn. 1758.1

Fishes, p. 70-84; 89-90.

This is Horrebow's own work, but it abounds in foot-note references to Anderson, J., this section (q. v.).

Hortop, Job [*fl.* 1567-1591] The rare *travaillies* of Job Hortop. Wherein is declared the dangers he escaped in his voyage to Gynnie . . . Wherein also he discovereth many strange and wonderfull things . . . also of monstrous beasts, fishes and foules. London, 1591. 4°. Pre-Linn. 1591.1

Hortus Sanitatis. See **Cube, J. von.**

Howlett, Robert. Angler's sure guide; or, angling improved and methodically digested. By R. H., forty years a practitioner in this art. London, 1700. 8°. Pre-Linn. 1700.1

Contains information about material for fishing, nature and habits of fish, preserving fish; fish ponds and laws of angling.

Other eds.: London, 1706, 1710, 1720, 1732, 1736.

Copies 1706 & 1732 eds., N. Y. P.

Hughes (Rev.) Griffith. The natural history of Barbados, in ten books. London, 1750. vii, 14, 314, 20 p. 29 pls. fol. Pre-Linn. 1750.1

Fishes, p. 299-314.

Humble, Nils (respond.) Disputatio de piscaturâ harengorum in Roslagiâ. Inaug. Dissert. Upsaliæ, 1745. 4°. Pre-Linn. 1745.1

Elias Frondius, *præses*.

Hume, Francis. Experiments on fish and flesh preserved in lime-water. Phil. Trans. Roy. Soc., 1753 (1754), 48, 163-164. Pre-Linn. 1754.1

German translations in: *Physical. Patriot.*, Hamburg, 1756, 1. — *Allg. Magaz. Natur. Kunst. Wissen.*, 6. — *Wittenb. Wochenbl.*, 1770, 3, 101. — *Beyträg. Naturg. Mineralreiches*, Th. 1.

I

Ilstrom, Johann. Vom Fischfange in Preussen, und dem Fischfange mit Kockelskernern. Samml. Nat. u. Med., Kunst u. Litt.-Gesch., Breslau, 1721, 15. Vers., 181. Pre-Linn., 1721.1

— Beskrifning om körfogelens [*Mergus merganser*] nytta, när fiskehus blifva bygde för honom uti salt-eller insjö-vikar. K. Svensk. Vetensk. Acad. Handl., 1749, 10, 190–196.

Pre-Linn. 1749.1

— Beschreibung des Gebrauches der Tauscher-Gans, wenn für sie Fisch-Häuser an Meerbusen oder Seen im Lande erbauet werden. König. Schwed. Akad. Abhandl., 1749 (1754), 11, 197–208. — Analect. Transalp., 1762, 2, 194–197.

Pre-Linn. 1754.1

See note under Kästner, A. G., Pre-Linn.

— Mittel, um eine Menge Fische mit der Angel oder Netze zu fangen. Brem. Magaz., 1757, 1, 2. St., no. 59.

Pre-Linn. 1757.1

Imperato, Ferrante [1550–1625] *Historia naturale*, nella quale si tratta della diversa condizion de minere, pietre preziose, e altre curiosita, con varie istorie di piante e animale. Napoli, 1593. fol.

Pre-Linn. 1593.1

This is the exceedingly rare and almost unknown first edition. The following, a "second impression" it is called, is commonly taken for the first edition.

— Dell' historia naturale . . . libri xxviii, nella quale ordinatamente si tratta della diversa condition di minere e pietre. Con alcune historie di piante & animali; sin' hora non date in luce. Napoli, 1599. xxiv, 791 p. figs.

Pre-Linn. 1599.1

— Discorsi intorno a diversi cose naturali. Napoli, 1628. 2 pls. 4°.

Pre-Linn. 1628.1

Contains a reference to object called "batrachite," or "boufonite."

— *Historiæ naturalis libri xxix*. Accesserunt nonnullæ Johannis Mariæ Ferri adnotationes ad librum xxviii. Nunc primum ex italica in linguam con-

versa latinam. Coloniae, 1695. 928 p. figs. 4°.

Pre-Linn. 1695.1

Probably the best ed. of the "Historia."

Other eds. in Italian are: Naples, 1610, 4°, & Venice, 1672, fol. with 669 woodcuts. Versions are said to have been issued in Latin, at Cologne, Leipsic & Bremen in 1692 or 1695.

Copies of early eds. in H., Arn., A. M. N. H., P. A. S.

Imperato, who was a pharmacist of Naples, possessed a cabinet of curiosities which are described in the work listed above. According to Schröter and Haller, the real writer of the book was Nicolas Antonio Stelliola, who did the work for a price, while Imperato wrote himself down as the author. The descriptions of animals form a comparatively small part of the whole, which has mainly to do with agriculture and mineralogy. Among the illustrations is the earliest printed figure of the remora.

Ingrams, — *Tractatio de torpedine anglie*. (In Student of Oxford, no. 2.) — Hannover. Gel. Anz., 1750, 83.

Pre-Linn. 1750.1

Isachius, Alfonsus. *De venatione tractatus*, in quo de piscatione, aucupio, sylvestriumque insectatione agitur. Regii, 1570. 8°.

Pre-Linn. 1570.1

2nd ed.; Regii, 1625. 4°.

Isidore of Seville (Lat. **Isidorus Hispalensis**) [c. 560–636] *Liber etymologiarum*. Augsburg. 1472.

Pre-Linn. 1472.1

Probably the 1st ed.; another, Venice, 1483. Copies, A. T. M., U. C.

— *Originum libri xx*, variis lectionibus et scholiis illustrati opera Bonav. Vulcanii. Basilæ, 1577. fol.

Pre-Linn. 1577.1

Lib. xii., de animalibus.

— *Originum, seu etymologiarum, libri xx*. Parisiis, 1580.

Pre-Linn. 1580.1

Lib. vi, cap. 6. *De ordine creaturum*. Thirty or more species of fish are enumerated, and indications are given in what seas and rivers they occur.

— *Opera*. Parisiis, 1601. 1 vol. fol.

Pre-Linn. 1601.1

Modern eds. of the "Etymologiarum" are:

Isidori Hispalensis episcopi etymologiarum libri xx. edidit F. V. Otto. (In Lindemann. *Corpus grammaticorum Latinorum veterum*, &c. vol. III. Lipsiæ, 1833. 4°.)

Isidori Hispalensis episcopi *Etymologiarum sive originum libri xx* recognovit, etc. W. M. Lindsay edidit. 2 vols. Oxonii, 1911.

J

J., A. A conjecture concerning the bladders of air that are found in fishes; illustrated by an experiment suggested by Robert Boyle. *Phil. Trans. Roy. Soc.*, 1675, **10**, 310–311.

Pre-Linn. 1675.1

Often erroneously ascribed to Boyle.

Jacob, Giles, [1686–1744] The country-gentleman's vade mecum; containing . . . fish and fishing, fish-ponds, etc. London, 1717. 8°.

Pre-Linn. 1717.1

Fishes, p. 25–31.

— The compleat sportsman; in three parts. Part iii: Of fish and fishing, etc. London, 1718. xii, 142, iv p. 12°.

Pre-Linn. 1718.1

Fish and fishing, p. 114–152.

— Game law; and of hawking, hunting, fishing and fowling. 7. ed. London, 1740. 8°. Pre-Linn. 1740.1

Jacobæus, Oliger [1650–1701] *Acta marini anatomi*. *Acta Med. Phil. Hafn.*, 1673 (1675), **2**, 140–154.

Pre-Linn. 1675.1

Not seen. Carus & Engelmann assign this title to Borrich, O. (Pre-Linn. 1675.1); Agassiz to Jacobæus; and both Gronovius & Walbaum list it under both authors.

— *Anatome piscis centrinae, Italici pesci porco*. *Act. Soc. Sci. Reg. Hafn.* 1677–79 (1680), **5**, 251–253.

Pre-Linn. 1680.1

— *Anatome piscis torpedinis motusque tremuli examen*. *Acta Soc. Sci. Reg. Hafn.*, 1677–79 (1680), **5**, 253–259.

Pre-Linn. 1680.2

— *De Lampetra eiusque pulmonibus et anguilla*. *Act. Med. Phil. Hafn.*, 1677–79 (1680), **5**, 259–261.

Pre-Linn. 1680.3

— *Museum regium seu catalogus rerum tam naturalium, quam artificialium quæ in basilica bibliothecæ augustissimi Danicæ Norvegicæq; Monarchæ Christiani V, Hafniæ asservantur, &c.* Hafniæ, 1696. 214 p. 37 pls. fol.

Pre-Linn. 1696.1

Some marine fishes and their parts are described.

— *Auctarium rariorum musei regii. Hafniæ*, 1699. fol. Pre-Linn. 1699.1

— *Museum regium, seu catalogus rerum tam naturalium, quam artificialium, quæ in Hafniæ asservantur in basilica bibliotheca Friderici IV. Danicæ & Norvegicæ monarcha . . . ab O. Jacobæo . . . quondam descriptus, nunc vero magna ex parte auctior uberioribusque commentariis . . . illustratus, accurate J. Lauerentzen.* Havniæ, 1710. 260 p. 56 pls.

Pre-Linn. 1710.1

This is a revised and enlarged edition of the 1696 work. See also Laurenzen, J., this section.

Jago, Georges (*Curé de Cornuailles*) [Descriptions of and notes on a few kinds of fishes, communicated to John Ray, and published by the latter in his *Synopsis methodica piscium*, 1713. (q. v.)]

Pre-Linn. 1713.1

Reference from Cuvier & Valenciennes.

Jeraucurius, Anan. *Explicatio characterum, qui inventi fuerunt in lateribus duarum Halecum* [Herring], quæ fuerunt in Dania et Norwegia captæ. 1588. fig. 8°. Pre-Linn. 1588.1

Johnson, Thomas [c. 1561–1644] *Cornucopiae, or, Divers secrets, wherein is contained the rare secrets of man, beasts, foules, fishes and such like . . . not before committed to be printed in English: newlie drawn out of divers Latine authors into English.* 1595. 4°. Pre-Linn. 1595.1

Jonston, John [1603–1675] *Thaummatographia naturalis, in decem classes divisa, in quibus admiranda cæli, elementorum, meteororum, fossilium, plantarum, avium, quadrupedum. exsanguium, piscium et hominis.* Amstelodamæ, 1632. 501 p. fol.

Pre-Linn. 1632.1

Other eds. appeared in 1632, 1633, 1661 & 1665, and an English version (noted below) in 1657.

— *Historia naturalis de piscibus et cetis libri v, cum æneis figuris.* (Pars I). *Francofurti ad Mœnum*, [1649]. 228 p. 47 pls. fol. Pre-Linn. 1649.1

This work is in two parts; the title-page of the first part is undated, and that of the second part, dated 1650, reads:

Historiæ naturalis de exsanguibus aquaticis libri iv, cum figuris æneis Francofurti-ad-Mœnum, 1650.

The two parts of this work were republished under a new title at Amsterdam in 1657. There are also other eds. of 1665, 1677, & 1718. This last appears under a new title quoted later.

According to Agassiz, Jonston's previously published works on quadrupeds, birds, fishes, and insects, were united and published in folio under the following title and in various editions as indicated in footnote.

— *Historia naturalis animalium. Francofurti, 1650. figs. fol.*

Pre-Linn. 1650.1

Other eds. are: Frankfort, 1653 & 1662; Amsterdam, 1657, & 1678 (English).

— An history of the wonderful things of nature, set forth in ten severall classes. Wherein are contained . . . ix. The wonders of fishes. Written by Johannes Jonstonus, and now rendered into English by a person of quality. London, 1657. Pre-Linn. 1657.

This is a translation of the author's "Thaummatographia naturalis," 1632.

Wonders of fishes, Classis ix, pp. 289-306.

— Beschryving van de natuur der vissen en bloedloose waterdieren. Amsterdam, 1660. fol. Pre-Linn. 1660.1

— *Theatrum universale omnium animalium, piscium, avium, etc. CCLX tabulis ornatum. Ex scriptoribus tam antiquis quam recentioribus, . . . maxima cura a J. Jonstonio collectum, ac plus quam trecentis piscibus nuperrime ex Indiis Orientalibus allatis, etc. . . . cura Henrici Ruysch. 6 parts [in 2 vols.] Amstelodami, 1718. illust. fol. Pre-Linn. 1718.1*

Tomus I, pars prima. Continet collectionem novam piscium Amboinensium ac historiam naturalem piscium et avium. pp. 1-40. 21 pls.

Tomus I, pars secunda. *Historia naturalis piscium.* pp. 1-160. 48 pls.

This work is a reprint of the author's "Historia naturalis de piscibus et cetis" (1649), together with other writings by him and by Frederic Henri Ruysch, M. D. This edition of the "Theatrum" is often cited in bibliographies under the name of Ruysch alone, leading to much confusion. See Ruysch, F. H. Pre-Linn. 1718.1 Other eds. of the Theatrum are: Heilbronn, 1755-57; Rouen, 1768.

This writer, of a family originally Scotch, was born at Lessno or Lessa, in Posen. His great service was in bringing together into one work the scattered observations of the many writers on ichthyology who had preceded him. Most of his data and figures are copied from Belon, Rondelet, Gesner, Olaus Magnus, Schonevelde, Marcgrave, and others. His books enjoyed great popularity and were many times republished in parts or in whole, in the original Latin or in translation. The various editions are with much difficulty set in order bibliographically.

The order above is approximately correct only. An absolutely correct bibliography of Jonston can only be made from the books themselves.

Jorath or Jorach [12th cent.] *De animalibus.* MS.

The natural history work by this 12th century oriental, perhaps Syrian writer, no longer extant, is frequently quoted by Albertus Magnus, Vincent de Beauvais, Konrad of Megenberg and Bartholomew Anglicus.

The identity of the author is uncertain. M. Steinschneider (*Mém. Acad. Imp. Sci. St. Petersb.*, 1869, 3. ser. 13, 128) suggests tentatively that "Jorath Chaldæus," as he is called by Bartholomew, may be the same as "Phoron Chaldeus."

Josselyn, John [fl. 1633-1675] *New Englands rarities discovered: in birds, beasts, fishes, serpents, and plants of that country . . . etc.* London, 1672. 114 p. pls. cuts. sm. 8°.

Pre-Linn. 1672.1

Fishes, p. 23-37; 95-97.

This work has been twice reprinted; first in "Archæologia Americana." *Trans. & Colls. Amer. Antiq. Soc.*, 1860, 4, 133-238. The second is a verbatim et literatim reprint by Wm. Veazie, Boston, 1865. 169 p. 8°. Fishes occupy pp. 59-76. They are discussed in Rept. U. S. Fish Comm. 1871-72 (1873), 1, 149-150.

— An account of two voyages to New England . . . etc. By John Josselyn Gent. London, 1674. 279 p. sm. 8°.

Pre-Linn. 1674.1

List of fishes, p. 113-114.

The 2nd ed., being a reprint of the 1st dated 1664. The 3rd, identical with both, London, 1675. For a present day reprint, see *Colls. Mass. Hist. Soc.*, 1833, 3. ser. 3, 211-296.

Also reprinted verbatim by William Veazie, Boston, 1865. In this: fishes, p. 7-13; 82-89. Swordfish and whip-tailed shark attack whale, p. 7. Swordfish attacks ship, p. 12. The section on fishes is also found in Rept. U. S. Fish Comm. 1871-72 (1873), 1, 150-151.

Jovius, B. See **Giovio, B.**

Jovius, P. See **Giovio, P.**

Jussieu, (Le Cadet) *Observation sur deux petits poissons réunis par le ventre.* *Mém. Acad. Sci. Paris*, 1754, hist., 30. Pre-Linn. 1754.1

Jussieu, Antoine de [1686-1758] *Recherches physiques sur les pétrifications qui se trouvent en France de diverses parties de plantes et d'animaux étrangers.* *Mém. Acad. Sci. Paris*, 1721 (1723), (hist., 1-4), 69-75; 322-324. 2 pls. Pre-Linn. 1723.1

Teeth of myliobatid rays figured and described.

— *Sur les pierres appelées yeux de serpents et crapaudines.* *Mém. Roy. Acad. Sci.*, 1723 (1725), 205-210. pl. Pre-Linn. 1725.1

Pharyngeal teeth of *Labrus* from Brazil.

K

Kaempfer, Engelbert [1651–1716]
For a sketch of his life, see the fourth entry below.

— *Dissertatio medica inauguralis sistens decadem observationem exoticarum. Lugduni Batavorum, 1694. 4°.*
Pre-Linn. 1694.1

"In ea agitur de . . . torpedine Sinus persici . . ."

— *Amœnitatum exoticarum politico-physico-medicarum fasciculi v, quibus continentur variæ relationes, observationes et descriptiones rerum Persicarum et ulterioris Asiæ, etc. Lemgovia, 1712. xiv, 912 p. 16 pls. 4°.*
Pre-Linn. 1712.1

Torpedo sinus persici, p. 509–515. fig.

— *Anatome torpedinis sinus Persici. (In Valentini, M. B. Amphitheatrum Zootomicum, Francofurti, 1720, pt. II, 115–117. pl. 59.)*
Pre-Linn. 1720.1

— The history of Japan, giving an account of . . . its metals, minerals, trees, plants, animals, birds and fishes . . . with a description of . . . Siam. Written in High-Dutch . . . and translated . . . by J. G. Scheuchzer . . . with the life of the author and an introduction, etc. 2 vols. London, 1727. lii, 612, 75, 11 p. 45 pls. fol.
Pre-Linn. 1727.1

Fishes, p. 34; 95–101. pls.
Various versions and editions follow.

— *Histoire naturelle . . . de l'empire du Japon . . . traduite en François sur la version Angloise de J. G. Scheuchzer. 2 vols. La Haye, 1729. illust. fol.*
Pre-Linn. 1729.1

Another French ed.: 3 vols. Amsterdam, 1732.

— *De beschryving van Japan . . . Uyt het Engelsch [of J. G. Scheuchzer] in 't Nederduytsch vertdalt. Amsterdam, 1729. 50, 500 p. 32 pls. 6 maps. fol.*
Pre-Linn. 1729.2

Also published in abbreviated form in Arkstee & Merkus, "Allg. Hist. Reisen," 1753, vol. XI; and in Pinkerton's *Voyages*, 1811, vol. VII.

Other eds. are: London (2nd English ed.), 1728; The Hague, 1729 (2 eds. French & Dutch), 1731 & 1732; Rostock, 1749 (German); Moscow,

1773 (Russian); Lemgo, 1774, 1777, 1779 (German).

The excellent English version of 1729 is available for present day readers as:

The history of Japan with a description of the kingdom of Siam, 1690–92 (J. G. Scheuchzer trans.) 3 vols. London, 1729. Reprinted by James McLehose & Sons, Glasgow, 1906.

The fishes of Japan with vernacular and Dutch names and 12 figs., vol. I, p. 217–235. Poisonous fishes, p. 217–222.

Kästner, A. G. (translator) [1719–1800] Kästner translated *Kongliga Svenska Wetenskaps Akademien Handlingar*, 1739–1779, 40 vols., into German and published the series at Hamburg and Leipsic, 1749–1783, in 41 vols. under the title *Der Königlicher Schwedischen Akademie Abhandlungen*. Of the *Nya Handlingar* (1780–1812), he translated the issues for the years 1780–1790 and published them in 12 volumes at Leipsic in 1784–92, under the title *Neue Abhandlungen*, etc. This will explain why the same article appears in both Swedish and German.

Kalm, Pehr [1715–1779] P. Kalm's . . . *Wästgötha och Bohusländska resa. Förrättad år 1742. Med anmärkningar uti historia naturali, physique, medicine etc. Stockholm, 1746. iv, 304, 14 p. illust. 8°.*
Pre-Linn. 1746.1

Some fishes mentioned.

— (*præses*) *Enfalliga anmärkningar om Ost-Giötha Skäre Boars öfliga fiskesätt i Ostersjön. Inaug. Dissert. Abo, 1753. 46 p. 4°.*
Pre-Linn. 1753.1

Johannes Eliæson Enholm, *respond.*
Pisces, p. 8–20. A 2nd ed.: Abo, 1754. 28 p. 4°.

— (*præses*). *Dissertatio de causis diminutionis piscium. Aboæ, 1757, 9 p. 4°.*
Pre-Linn. 1757.1

Gust. Lindblad, *respond.*
For later works of P. Kalm, see in Vol. I.

Kamel, George Joseph [1661–1706] *De piscibus, molluscis et crustaceis Philippensibus. Phil. Trans. Roy. Soc. London, 1705 (1706), 24, 2043–2080.*
Pre-Linn. 1706.1

Kannegiesser, Gottlieb Heinrich. *De cura piscium per Slesvici et Holsatiæ*

ducatum usitata libellus. Kilonii, 1750. 130 p. 10 pls. 8°. Abstracts in Gel. Nachr. Hamburg. Corresp., 1751, 30. St. — Berlin Wochenbl., 1751, no. 22. — Erlang. Beytr., 1751, 253.

Pre-Linn. 1750.1

Kanold, Joh. [c.1679–1729] Von dem Fische Carcharias, oder See-Hunde. Samml. Nat. u. Med., Kunst u. Litt.-Gesch. Breslau, 1721, 16. sec., 635.

Pre-Linn. 1721.1

Katzbeccius, George (*respond.*) Dissertatio de jure thesaurorum invenientium, deque respiratione piscium, testatorum, crustatorum, mollium et insectorum. Coburg, 1609. 4°.

Pre-Linn. 1609.1

Andreas Libavius, *præses*.

Keill, James [1673–1719] A practical treatise upon angling with small and great rode, shewing the different flies and baits through the various seasons of the year; to which is adjoined fishing in ponds. Edinburg, 1729. 16 p. 8°.

Pre-Linn. 1729.1

Kentmann, Johannes [1518–1574] For comments on the work of this author as the oldest student of fossil fishes, see Zaunick, Rudolph. "Fragmente der ältesten sächsischen Fischfauna des Dr. Johannes Kentmann (1518–1574)." Abh. Naturwiss. u. Entwick. Ges. Isis, Dresden, 1915, p. 15–36.

— Nomenclaturæ rerum fossilium que in Misnia præcipue, & in aliis quoque regionibus inveniuntur. (In Gesner, C. De omne rerum fossilium genere, gemmis, lapidibus, metallis, etc. Tiguri, 1565)

Pre-Linn. 1565.1

On folio 31 is the earliest known description of "Glossopetræ," fossil sharks' teeth; on folio 32, a reference to fossil fish scales.

Keogh, J. Zoologia medicinalis Hibernica: or, a treatise of birds, beasts, fishes, reptiles or insects, which are commonly known and propagated in this kingdom: giving an account of their medicinal virtues, and their names in English, Irish, and Latin. Dublin, 1739. xvi, 167, 9 p. 8°.

Pre-Linn. 1739.1

Keyens, Otto. Het waere onderscheyt tusschen konde en warme landen, etc. s' Gravenhage, 1659.

Pre-Linn. 1659.1

The original Dutch ed. A German version is:

— Kurtzer Entwurff von Neu-Niederland und Guajana einander ent-

gegen gesetzt, umb den Unterschied zwischen warmen und kalten Landen herausz zu bringen, u.s.w. Leipzig, 1672. 4°.

Pre-Linn. 1672.1

Fishes, p. 27–29, 59–62, 114.

Khraisser, Sabastian. Jus venandi, aucupandi et piscandi, Romano-Bavaricum, etc. Neoburgi ad Istrum, 1651. viii, 138, xxii p. 16°.

Pre-Linn. 1651.1

Kiranus, — Kiranides, & ad eas Rhyakini Koronides, quorum ille in quaternario tam librorum quam elementari e totidem linguis, primo de gemmis XXIV, herbis XXIV, avibus XXIV, ac piscibus XXIV quadrifariam semper & fere mixtim ad tetrapharmacum constituendum agit: In libro II de animalibus XL; in lib. III de avibus XLIV sigillatim, & in lib. IV de LXXIV piscibus iterum, eorumque viribus medicamentosis. Lipsiæ, 1638. 12°.

Pre-Linn. 1638.1

Not seen. Very rare. Title from Gronovius. Kiranus, king of Persia, described in Arabic certain fishes. This book was translated into Greek, and finally into Latin as above. A later ed. is:

— Mysteria physico medica, de lapidibus, piscibus, herbis, volucris. Frankfort, 1681. 12°.

Pre-Linn. 1681.1

— The magick of Kirani, King of Persia; and of Harpocraton. London, 1685. 8°.

Pre-Linn. 1685.1

An English version of the preceding.

Kircher, Athanasius [1601–1680] For a sketch of this learned Jesuit, see Walsh, J. J. "Father Kircher, — scientist, orientalist and collector." Eccles. Review, Philadelphia, 1904, 31, 459–474.

— Magnes, sive De arte magnetica; opus tripartitum, quo præterquam quod universa magnetis natura, eiusque in omnibus artibus et scientiis usus nova methodo explicetur, e viribus quoque et prodigiosis effectibus magneticarum, aliarumq, etc. Colonia Agrippinæ, 1643. 797 p. & index. 8°.

Pre-Linn. 1643.1

Lib. III, pars vi, p. 657–677, De magnetica facultate, sive magnetismo animalium. Caput 2, sect. 1, Magnetismus bufonis et mustelæ. Sect. 3, De echeinidis seu remoræ, aliarumque marinarum animalium magnetismus. Sect. 4, De torpedinis magnetismo. Sect. 5, De magnetismo Ranæ piscatricis. Sect. 6, De magnete Æolio, seu quod idem est, de physa, seu orbe pisce Ægyptiaco.

The 2nd ed.; 1st: Rome, 1641; others: Cologne, 1642; Rome, 1654 & 1674.

Kircher, A.

— *Magneticum naturæ regnum, sive disceptatio physiologica de triplici in natura rerum magnete, etc.* Amstelodami, 1667. 201 p. 12°.

Pre-Linn. 1667.1

Sectio iv, Caput 1, De magneto *Æolio*, sive ventorum demonstratore [Describes a fish called "Voladores"] Caput 2, Quomodo magnetismus inter mustelam et bufonem, remoræ et torpedinis intelligendus sit. Caput 3, De magnete navium, quæ remora seu echeneis dicitur. Caput 4, Alius magnes in certa conchyliorum specie noviter detecta torpedinis vim habens.

— *Mundus subterraneus in XII libros digestus, etc.* 2 vols. Amstelodami, 1678. fol. Pre-Linn. 1678.1

Fossil fishes, vol. II, p. 37-38, figs.; 41-42. Monoceros (*Xiphias*), pp. 56-67. Fossil fishes, p. 91-94.

2nd ed.: 1st., Amsterdam, 1664-65. Dutch version, "Onderaardsche Weerelt," etc., Amsterdam, 1682. An abbreviated ed.: "Synopsis mundi subterranei," Herbipoli, 1660. 4°. Copy 1678 ed., N. Y. P.

— *Romani Collegii Societatis Jesu Musæum celeberrimum, cujus magnum antiquariæ rei, statuarum, imaginum, picturarumque partem. Ex Legato Alphonsi Donini . . .* Amstelodami, 1678. 66 p. fol. Pre-Linn. 1678.2

Volador, *Xiphias*, Raja, Torpedo, briefly described p. 23-35.

Kircher, J. *Jocoseriorum naturæ et artis, das ist: 300 nützliche und lustige Sätze aus der Kunst und Natur, oder natürliche Magie.* Bamberg, 1677. 4°. Pre-Linn. 1677.1

"Bevat ook visscherij-geheimen." — Bosgoed

Kirchmaier, — (*respond.*) *Disseratio de magno pisce, qui Jonam vatem deglutivit.* Wittembergæ, 1705. 2 pl. 4°. Abstract in *Nouv. Liter. German.* Hamburg, 1705, 447.

Pre-Linn. 1705.1

"Carchariam fuisse asserit."
Joh. Frid. Hertenstein, *præses*.

Klein, Jacob Theodore [1685-1759] *Historiæ naturalis piscium promovendæ missus V, cum præfatione de piscium auditu.* 5 parts [in 1 vol.] Gedani, 1740-1749. 54 pls. gr. 4°.

Pre-Linn. 1740.1

i. De lapillis eorumque numero in craniis piscium, cum præfatione: de piscium auditu. Accesserunt . . . *Observata in capite Raiæ.* 1740. 36 p. 6 pls.

ii. De piscibus per pulmones spirantibus ad iustum numerum et ordinem redigendis. Accesserunt singularia: de . . . *Lapide Manati et Tiburonis . . .* 1741. 38 p. 6 pls.

iii. De piscibus per branchias occultas spirantibus ad iustum numerum et ordinem redigendis. Cum observationibus circa partes genitales *Rajæ maris*, et ovarium *Galei.* 1742. 48 p. 7 pls.

iv. De piscibus per branchias apertas spirantibus ad iustum numerum et ordinem redigendis. Horum series prima cum additamento ad missum tertium. 1744. 68 p. 15 pls.

v. De piscibus per branchias apertas spirantibus. Horum series secunda cum additionibus ad missus II, III, IV, et epistola: de cornu piscis *carinæ navis* impacto. 1749. 102 p. 20 pls.

"A remarkable work. It perhaps surpasses all other ichthyological publications in incongruities between the definitions of groups and the contents thereof, and it is difficult to conceive how some could have originated. The definitions themselves are sufficiently clear, and their practical application to forms would not appear to be difficult; the author however seems to have practically ignored his definitions of groups when once framed, and to have proceeded, as some more modern naturalists have done, by successive approximations of other forms to the types of his definitions, and without checking the results by subsequent comparison with the latter." — T. N. Gill, *Smithson. Misc. Colls.*, 1872 (1874), 11, no. 247, p. 29. For a contemporary review of the above work of Klein, see Eames, John, in this section.

2nd ed.: Leipsic, 1802. (Klein, J., 1802.1.)

— *Mantissa ichthyologica de sono et auditu piscium; sive, Disquisitio rationum, quibus autor epistolæ in bibliotheca gallica de auditu piscium, omnes pisces mutos surdosque esse, contendit.* Lipsiæ, 1746. 4, 30 p. 4°.

Pre-Linn. 1746.1

The letter referred to was published in the *Bibliothèque Française*, tom. XXXVI, pt. II, p. 273, etc. An abstract in English is found in *Phil. Trans. Roy. Soc. London*, 45, p. 233. See Brockelsby, R., 1750.1, this section.

— *Dass Fische weder stumm noch taub sind.* *Abh. Nat. Ges. Danzig*, 1747, 1. Th., 106-143.

Pre-Linn. 1747.1

For other papers by this author and for later editions of the above, see Klein, J. T., in vol. I.

Knorr, George Wollfang [1705-1761] *Deliciæ naturæ selectæ, oder auserlesenes Naturalien-Cabinet, welches auch den drey Reichen der Natur zeigt was, von Curiosen Liebhabern aufbehalten und gesammelt zu werden verdienet.* Nürnberg, 1754. pls. fol.

Pre-Linn. 1754.1

For a second and enlarged ed., see Knorr, G. W., 1766.1. Other eds. are: Nürnberg, 1776, 1777 & 1778; Dordrecht, 1771 (Dutch), & Amsterdam, 1773.

— *Sammlung von Merkwürdigkeiten der Natur und Alterthümern des Erdbodens, welche petrificirte Körper enthält. Lapidés diluvii testes, quos in ordines et species distribuit, suis coloribus exprimit, ærique incisos in lucem mittit* Knorr. Noribergæ, 1755. figs. fol. Pre-Linn. 1755.1

For later eds., see, Knorr, G. W., 1775.1, & Knorr & Walch, 1768.1.

Knox, Robert [c. 1640–1720] An historical relation of the island of Ceylon in the East Indies, with an account of his escape from captivity. London, 1681. pls. map. portr. fol.

Pre-Linn. 1681.1

Fishes and fishing, pp. 27–29. fig.

The 1st ed. Others are: Paris & Lyons, 1664 (French); Leipsic, 1681, 1684, 1689 (German); Amsterdam, 1693 (French), and a Dutch version as follows:

— 't Eyland Ceylon in zijn binnenste, of 't Koningrijk Candy geopen, en nauwkeuriger dan oyt te voren ontdeekt; vertaeld door S. de Vries. Utrecht, 1692. pls. map. 4°.

Pre-Linn. 1692.1

Fishes, pp. 39, 40, 58.

Under the heading "Reise nach Ostindien [Ceylon, 1657–1659]" it was reprinted in Arkstee & Merkus, Allg. Hist. Reisen, 1751, Bd. VIII. But it is most available for the English reader in the fine verbatim reprint issued by MacLehose at Glasgow, 1911, concerning which the following notes are added: "It was first printed by Richard Chiswell, 1681, and was reprinted by Harris, who translated it into French, Dutch and German. The present reprint not only reproduces the original text and the quaint original woodcuts, but also adds a hitherto unpublished autobiography and other notes which were discovered by the late Mr. Donald Ferguson in manuscript, bound up with a copy of the 'Historical relation of Ceylon' in the Bodleian Library."

Knutberg, Carl. Erfindung See-hunde zu fangen. K. Svensk. Vetensk. Akad. Handl., 1755, 16.

Pre-Linn. 1755.1

Koenig, Emanuel [1658–1731] Regnum animale sectionibus tribus physice, medice, harmonice, mechanice, theoretice, practice evisceratum, enumeratum & emedullatum; hominis scilicet & brutorum mechanicam hydraulico-pneumaticam comparate, item quinque classes universales ac usum cibarium & medicinalem curiosis quibusvis proponens. Coloniae, 1682. 4°.

Pre-Linn. 1682.1

According to Agassiz, there was a simultaneous issue at Basel, 1682. Other eds. are: Basel, 1688 & 1692; Cologne, 1698 — the latter much augmented.

The 1692 ed. (in N. Y. P.) contains 192 pages and has fishes, their parts and uses; pp. 12, 19, 38, 110–112; their uses in medicine, pp. 153–155.

— Lupi piscis et mugilis ventriculi conformatio. Ephemer. Acad. Nat. Cur., 1686 (1687), dec. 2, ann. 5, 208–209.

Pre-Linn. 1687.1

— De glossopetris in Helvetia repertis. Ephemer. Acad. Nat. Cur., 1689 (1690), dec. 2, an. 8, 303.

Pre-Linn. 1690.1

— De ranæ piscatricis anatome [Lophius]. Ephemer. Acad. Nat. Cur., 1694 (1695), dec. 3, an. 2, 204–207.

Pre-Linn. 1695.1

The same is also included in Valentini, M. B. "Amphitheatrum Zootomicum," 1720, pt. II, pp. 134–135.

Koenig, Samuel Fridericus. Dissertatio inauguralis de lamia Plinii, etc. Argentorati, 1742. iv, 20 p. pls.

Pre-Linn. 1742.1

Lamia, a kind of flat fish. See Pliny, "Natural history of animals," 9, 24, 40.

Kolbe, Peter [1675–1726] For a biography, see sketch by Oertel, Georg Christian. Neustadt, 1758. 4°, and a review of the same in Erlangen Gelehrte Anmerk., 1758, 195.

— Caput Bonæ Spei hodiernum, Das ist vollständige Beschreibung des afrikanischen Vorgebirges der Guten Hoffnung, worinnen abgehandelt wird, wie es heut zu Tage nach seiner Situation und Eigenschaft aussieht, ingleichen was ein Naturforscher in den drei Reichen der Natur daselbst findet, etc. 3 parts (in 1 vol.) Nürnberg, 1719. 26 pls. fol.

Pre-Linn. 1719.1

Versions in other languages follow.

— Naauwkeurige beschryving van de Kaap de Goede Hoop; behelzende een geleerde beschryving van deszelfs dieren, visschen, vogelen, enz. Amsterdam, 1727. 2 vols. fol.

Pre-Linn. 1727.1

— The present state of the Cape of Good Hope, etc. 2 vols. London, 1731. pls.

Pre-Linn. 1731.1

Vol. I. Hottentot manner of fishing, pp. 256–259. Vol. II. "Sea and river fish at the Cape of Good Hope," pp. 186–208. pls. viii & ix.

Other eds.: 1735 & 1738.

— Description du Cap Bon Espérance. 3 vols. Amsterdam, 1741–43.

Pre-Linn. 1741.1

— Beschreibung des Vorgebürges der Guten Hoffnung und derer darauf wohnenden Hottentoten. Frankfurt & Leipzig, 1745. 4°. Pre-Linn. 1745.1

Koleffel, Matthias Jacobus (respond.) Disputatio juridica de piscatione . . . M. J. Koleffel, Ravenspurgensis, auctor et respondens. Basil, [1684]. 48 p. 6 pls. 4°.

Pre-Linn. 1684.1

Jacob Burckhard, præses.

Konrad of Megenberg (Canon of Regensburg) [1309–1378] Das Register . . . Hye nach volget das Puch der

Konrad of Megenberg.

Natur . . . Welches Puch Meister Cunrat von Megenberg von Latein in Teutsch transzferiet und geschriben hat. Augsburg, 1475. 292 leaves. 12 woodcuts. sm. fol. Pre-Linn. 1475.1

Sec. xii, pt. v, contains fishes.

First ed. (copy, J. P. M.). Others: Augsburg, 1478, 1481, 1482 (2 separate printings by different printers), 1489, 1499; Frankfort, 1536 & 1540; Leipsic, 1505; Venice, 1508; Turin (Italian), 1508.

The best eds. probably are:

— Naturbuch von Nutz, Eigenschaft, Wunder, Wirkung und Gebrauch aller Geschöpfe, Element und Creaturen. Augspurg, 1489. fol. Pre-Linn. 1489.1

— Das Buch der Natur . . . Wöchliches Buch Meyster Cunrat von Megenberg von Latein in Teutsch transzferiet und geschriben hat. Augsburg, 1499. 171 leaves. 14 woodcuts. sm. fol. Pre-Linn. 1499.1

For modern German versions, see:

Konrad of Megenberg Das Buch der Natur herausgegeben von F. Pfeiffer. Stuttgart, 1861.

Das Buch der Natur von Konrad von Megenberg. Eine Ausgabe in moderner Sprache. [Hugo Schulz, editor] Stuttgart, 1897.

Fishes treated & figured in books v & vi.

The compiler of "Das Buch der Natur" is generally conceded to have been Konrad, Canon of Regensburg. The real author is unknown, but his work was written in Latin and translated into German by Konrad in the year 1349. The authorship of the Latin original has been attributed to Albertus Magnus (1193-1280), and to Thomas Cantimpratus (1186-1263). Since Albert is quoted freely in the book, he could hardly have been its author. Nor does it seem that it can be attributed to Thomas whose compilation, "De rerum natura libri XX," is quite unlike it. It is probable that the German translator of the Latin original did not know the name of the compiler.

For a critical survey of the authorship and contents of the "Buch der Natur" see Choulant, L. "Graphische Incunabeln für Naturgeschichte und Medicin . . . des XV u. XVI Jahrhunderts." Leipzig, 1858, pp. 99-122. The same author discusses the authorship in: "Die Anfänge wissenschaftlicher Naturgeschichte und naturhistorischer Abbildung im christlichen Abendlande." Dresden, 1856. For reference to codices of "Das Buch der Natur," see Miller, C. 1897.1.

Kornmann, H. Templum naturæ historicum, in quo de naturâ et miraculis elementorum ita disseritur, ut nihil de rerum principiis, ignis naturâ, animalibus igneis, pyromanteiâ, animalibus aëreis, avibus, etc., de aqua, piscibus, maribus, fluminibus, de terrâ, animalibus terræ, etc. Lipsiæ, 1666. 8°. Pre-Linn. 1666.1

Also in his "Operibus eius curiosis." Francofurti, 1696. 8°.

Kozack, Jno. Sophronius [1603-1685] Mica I^a philosophiæ sacræ; oder Be-

schreibung der Geschöpfe des fünften Tages, nämlich der Fische und Vögel. Bremen, 1662. 8°. Pre-Linn. 1662.1

Kramer, Wilhelm Heinrich. Elenchus vegetabilium et animalium per Austriam inferiorum observatorum, sistens ea in classes et ordines, genera et species redacta. Viennæ, Pragæ & Tergesti, 1756. pl. 8°. Pre-Linn. 1756.1

Thirty-eight fishes are described.

Kraut, George [fl. 16th cent.] Experimentarius medicinæ. Argentinae, 1544. fol. Pre-Linn. 1544.1

Deals with fishes in medicine among other things, according to Walbaum.

Kräutermann, Valentin. Compendieuses lexicon exoticorum et materialium, oder Beschreibung derer vornehmsten ausländischen Ost- und West-Indischen Materialien und Vegetabilien, ingleichen derer Fossilen, Metallen, wie auch aller ausländischen Thiere, Fische, und Vögel &c. Arnstadt, 1730. 552 p. 8°. Pre-Linn. 1730.1

Kreysig, George Christoph [1697-1758] For a sketch of his life, see Dresden. Gel. Anz., 1758, 379.

— Bibliotheca scriptorum venaticorum, continens auctores, qui de venatione, sylvis, aucupio, piscatura, et aliis eo spectantibus, commentati sunt. Altenburgi, 1750. 8°. Pre-Linn. 1750.1

Kronland, J. M. M. de. For a biographical sketch, see Láská, Václav. "Ueber Marcus Marci de Kronland." Zeitschr. Math. Phys., 1890, (Hist.-lit. Abth.), 35, 1-3.

— Philosophia vetus restituta, in qua de statu hominis secundum naturam agitur. Francofurti, & Lipsiæ, 1676. 4°. Pre-Linn. 1676.1

"De pisce echeneide, qua ratione navigia sistat," p. 574-580.

Kulmus, Joannes Adamus [1689-1745] Von dem Wasser- oder Fisch-Käfer, als einem bisher unbekannten Fisch-Räuber. Samml. Nat. u. Med., Kunst u. Litt.-Gesch. Breslau, 1719, 10. sect., 593. Pre-Linn. 1719.1

— Von einen gewissen Fisch-Insecto (Ephemera) Samml. Nat. u. Med. Kunst u. Litt.-Gesch. Breslau, 1723. 23. sect., art. 4, 292. Pre-Linn. 1723.1

Kundmann, Johann Christian. Rariora naturæ et artis. 1737. Pre-Linn. 1737.1

Measurement of *Carcharodon megalodon* estimated on basis of size of tooth, p. 86-91.

L

Laan, Adrian van der (engraver) [1684–1755] *Groote vissery*. Amsterdam, [c. 1700] 4°. Pre-Linn. 1700.1

Contains 16 engravings by Adrian van de Laan, from drawings by van der Meulen and others (all relating to the herring fishery).

Labat, Jean Baptiste [1663–1738] *Nouveau voyage aux isles de l'Amérique, contenant l'histoire naturelle de ces pays, . . . avec une description exacte & curieuse de toutes ces isles . . .* 6 vols. Paris, 1722. illust. 12°. Pre-Linn. 1722.1

— *Nieuwe reizen naar de Franse eilanden van America, etc.* 3 vols. Amsterdam, 1725. Pre-Linn. 1725.1

Later editions and translations are those of Paris, 1726, 1728, 1738, 1742; The Hague, 1724, 1738; Amsterdam (Dutch), 1722 & 1725; & Nuremberg (German), 1782–87.

— *Nouvelle relation de l'Afrique occidentale: contenant une description exacte du Sénégal et des pays situés entre le Cap-Blanc et la rivière de Serrelionne . . . l'histoire naturelle de ces pays, etc.* 5 vols. Paris, 1728. illust. 12°. Pre-Linn. 1728.1

Other eds. are: Paris, 1732 & 1758. Found also in Arkstee & Merkus. *Allg. Hist. Reisen*. Bd. III, as "Beschreibung Sierra Leona," etc., 1748.

— *Voyage du Chevalier des Marchais en Guinée, isles voisines et à Cayenne, fait en 1725, 1726, & 1727.* 4 vols. Paris, 1730. Pre-Linn. 1730.1

Vol. III, chap. x, marine and freshwater fishes described.

Another ed.: 1731.

— *Nouveau voyage aux isles de l'Amérique, contenant l'histoire naturelle de ces pays . . . Nouvelle édition augmenté considérablement, & enrichie de figures, etc.* 8 vols. Paris, 1742. 12°. Pre-Linn. 1742.1

This, the best ed. of Labat's "Nouveau Voyage," is the most copious work of the time that we possess on the Antilles. It is very full on the natural history of these islands.

La Chambre, Fr. de, & Baralis, B. See **Baralis & La Chambre**.

La Chesnaye Desbois, François Alexandre Aubert de [1699–1784] *Dic-*

tionnaire universel d'agriculture et de jardinage, de fauconnerie, chasse, pêche, etc. 2 vols. Paris, 1751. 4°.

Pre-Linn. 1751.1

— *Système naturel du règne animal, par classes, familles ou ordres, genres et espèces avec une notice de tous les animaux; les noms Grecs, Latins, & vulgaires, que les naturalistes leur ont donnés; les citations des auteurs qui en ont écrits . . . suivant la méthode de M. Klein; avec une notice de celle de M. Linnæus . . . & l'ordre poissons suivant la division de l'Artedi.* 2 vols. Paris, 1754. 8°.

Pre-Linn. 1754.1

Poissons, vol. I, p. 247–338. pl.

This work was published anonymously and has, by Engelmann and other bibliographers, been ascribed to M. J. Brisson, being confused with a work by this author bearing nearly similar title (see Brisson, M. J., Pre-Linn. 1754.1). However, it is now known to have been written by La Chesnaye Desbois, who has led to much confusion by publishing almost all his works anonymously. Copy vol. I, A. M. N. H.

Laet, Jan de [1593–1649] *Nieuwe Wereldt ofte beschrybinghe van West-Indien, wt veelerhande schriften ende aantekeningen van verscheyden natien by een versamelt. Door Ioannes de Laet, ende met noodighe kaerten ende tafels voorsien.* Leyden, 1625. xxii, 526 p. maps. fol. Pre-Linn. 1625.1

"See Asher's 'Essay,' no. 1. This invaluable work was much improved in the subsequent editions and translations by the author, but the maps were unchanged."—Sabin, *Bibl. Amer.*, 1878, XX, 15.

This is the rare 1st ed. The 2nd was issued at Leyden, also by Elzevir, in folio, 1630. Translations into various languages follow in chronological order.

— *Novus orbis seu descriptionis Indiæ Occidentalis Libri xviii. Authore Joanne de Laet Antwerp. Novis tabulis geographicis et variis animantium, plantarum fructuumque iconibus illustrati.* Lugduni Batavorum, 1633. 690 p. maps & cuts. Pre-Linn. 1633.1

"At p. 570 is found a chapter dealing with the fishes of Brasil, extracted from MS. sources." C. & V.

— *L'histoire du nouveau monde ou description des Indes Occidentales, contenant dix-huit livres, par le Sieur*

Laet, J.

Jean de Laet, d'Anvers; enrichi de nouvelles tables géographiques & figures des animaux, plantes & fruits. Leyde, 1640. 632 p. fol. Pre-Linn. 1640.1

— Historie ofte jaerlicjck verhael van de verrichtingen der . . . West-Indische Compagnie, zedert haer begin (1623) tot het eynde van 't jaer 1636. Leyden, 1644. xxxii, 544, 31 p. pls. maps. fol. Pre-Linn. 1644.1

— (editor) *Historia naturalis Brasiliæ*, etc. Joannes de Laet in ordinem digessit et annotationes addidit & varia ab auctore ommissa supplevit & illustravit. Lugduni Batavorum et Amstelodami, 1648. sect. i, 122 p. sect. ii, 292 p. figs. fol. Pre-Linn. 1648.1

The first section of this volume is composed of William Piso's "*De medicina Brasiliensi*," comprising four books. The second section is composed of George Marcgrave's "*Historiæ rerum naturalium Brasiliæ*." This latter, Laet found left in cipher by Marcgrave. He translated the cipher, added notes of his own (set in separately) and edited the whole work.

Cuvier & Valenciennes thus characterized Laet: "Directeur de la Compagnie Hollandaise des Indes Occidentales, grand promoteur de la géographie, éditeur de Marcgrave et auteur de plusieurs oeuvres."

Laet, S. V. *Voyagien naa en door het groot en magtigt Koninkryk van Persien . . . Begrijpende en verhandelende . . . vissen*, etc. Amsterdam, 1667. 4, 128 p. sm. 4°. Pre-Linn. 1667.1

Credited by P. A. Tiele to Jan de Laet.

La Hontan, (Baron) Jean de [c. 1666–1715] *Nouveaux voyages dans l'Amérique septentrionale*. 2 vols. La Haye, 1702. 12°. Pre-Linn. 1702.1

Other eds. are: The Hague, 1703, 1705, 1709, 1715, 1739; Amsterdam, 1728 & 1731; Hamburg & Leipzig, 1709, 1711. An English ed. is:

— *New voyages to North America*. 2 vols. London, 1703. 1, 280 p. 12 maps. cuts. Pre-Linn. 1703.1

Vol. I, p. 243–247 gives a list of the fish of the river St. Lawrence.

La Hontan's travels were reproduced in Arkstee & Merkus, *Allg. Hist. Reisen*, 1758, Bd. XVI, under the title "*Reise . . . auf dem langen Flusse* (1688)"; also in Pinkerton's *Collection of Voyages*, 1812, vol. XIII.

Lambach, Hier. *Consilium medicum, quo Raphani usus arguitur, leporis caro approbatur, nec non halecis recentissimi salubritas confirmatur*. Hamburg, 1603. 8°. Pre-Linn. 1603.1

Lambertus Audomarensis (St. Omer) *Liber floridus*. MS. c. 1077. Pre-Linn. 1077.1

Chapter LII, "*De monstris marinis et piscibus*."

This is a general digest of knowledge, historical, ecclesiastical and natural, taken from many writers. An account of it is given in Migne, 163, col. 1004 sqq. It is a predecessor of the "*Speculum*" of Vincent de Beauvais.

For brief data about the man and his work, descriptions of the extant MS. copies, and a list of chapter headings of his encyclopædia, see: Zacher, J. *Lamberti Floridus*. *Serapeum für Bibliothekwissenschaft, Handschriftenkunde und ältere Literatur*. Leipzig, 1842, 3. Jahrg., 145–154; 161–172.

Lamorier, L. *Sur un organe particulier du chien de mer*. *Mém. Acad. Sci. Paris*, 1742 (1745), hist., 32–33. Pre-Linn. 1745.1

Langius, Christ. *Anguilla, cœnarum helena*. (In his *Curiosis Medicis*, Frankfurt, 1688, 4°.) Pre-Linn. 1688.1

— *Vom Aalfange in Preussen*. *Samml. Nat. u. Med., Kunst u. Litt.-Gesch.* Breslau, 1719, 4. Vers., 1223. Pre-Linn. 1719.1

La Nux, — de. *Observation sur un poisson qui file une espèce de soie dans laquelle il se renferme avec ses œufs*. *Mém. Acad. Sci. Paris*, 1755, hist., 39–40. Pre-Linn. 1755.1

La Roque, — Abbé de. *De pisce remora . . . & de dentibus canis marini* (In *Zodiacus medico-gallicus, sive miscellaneorum curiosorum medico-physicorum sylloge continens celeberrimorum virorum tum medicorum aliorumque eruditorum in Gallia observationes, tum opuscula medica & physica Gallice emissa, & Latinitate donata*. Geneva, 1682, 4, 92.) Pre-Linn. 1682.1

Lawson, John. *A new voyage to Carolina; containing the exact description and natural history of that country: By John Lawson, Gent. Surveyor-General of North Carolina*. London, 1709. 258 p. pl. map. fol. Pre-Linn. 1709.1

Fishes, marine and freshwater, of North Carolina, p. 152–163.

This is next found in Stevens' "*Collection of Voyages*," London, 1711. A German version is:

— *Allerneuste Beschreibung der Provinz Carolina in West-Indien. Samt einem Reise-Journal von mehr als Tausend Meilen unter allerhand Indianischen Nationen. Auch einer accuraten Land-Carte und andern Kupfer-Stichen. Aus dem Englischen übersetzt*. Hamburg, 1712. 7, 365 p. sm. 8°. Pre-Linn. 1712.1

Fishes. p. 232–250.

Another German ed.: 1722; other English issues (reprints 1st ed.): London, 1714 & 1718. American reprints: Raleigh, N. C., 1860; Charlotte, N. C., 1903 (verbatim).

Lawson, or Lauson, William [fl. 1618] Editor of various editions of John Denny's "The secrets of angling." (q. v.)

Lebrun, Corneille. See **Bruyn, Cornelius de.**

Le Comte, Louis [c. 1650–1729] Beschryvinge van het machtige keysserryk China, behelsende d'overgroote provincien en menigvuldige steden, paleysen, rivieren; . . . etc. 2 vols. (in 1) The Hague, 1698. 398 p. figs. 4°. Pre-Linn. 1698.1

Gout-en silvervisschen, p. 89–91. Wonderlijke visschen, p. 376–383.

Original French ed.: Paris, 1696–97; another (3rd): Paris, 1698.

Ledel, Sam. [1644–1717] Carpiones diu viventes. Ephemer. Acad. Nat. Cur., 1691 (1692), 2. dec., ann. 10, 28–29. Pre-Linn. 1692.1

Leeuwenhoek, Antony van [1632–1723] For biographical notices, see: Miall, L. C. The Early Naturalists. London, 1912. p. 200–223: Locy, William A. Biology and its Makers. New York, 1908, p. 77–88, (portrait); Pop. Sci. Mo., April, 1901: Richardson, Disciples of Aesculapius, 1901, vol. II, p. 108; The Aesclepiad, 1885, vol. II. portrait, signature and other ills.

— Ontledingen en ontdekkingen van levende dierkens in de teel-deelen van verschede . . . visschen. Leyden, 1677. 4°. Pre-Linn. 1677.1

— Ondervindingen en beschouwingen der onsigtbare geschapene waarheden, vervat in verscheydene brieven, geschreeven aan de wytberœemde Koninglyke Societeit in Engeland. Leidæ, 1684. pls. 4°. Pre-Linn. 1684.1

In this collection of papers there are several dealing with fishes.

— Ondervindingen over het maaksel van't humor crystallinus son van verscheyde dieren, vogelen, ende visschen, het draad-agtig wesen dat in 'toog voet komt, enz. Leyden, 1684. 4°. Pre-Linn. 1684.2

— Abstract of a letter . . . concerning the scales of eels. Phil. Trans. Roy. Soc. London, 1685 (1686), 15, 893–895. Pre-Linn. 1686.1

— Ontleedingen & ontdekkingen van levenden dierkens in de teel deelen van verscheyden dieren, vogeln en visschen: van het hout met desselven

menigvaldigen natur. Leiden, 1686. 4°. Pre-Linn. 1686.2

— Anatomia & interiora rerum. Leidæ, 1687. 4°. Pre-Linn. 1687.1

Structure and flesh of fish. 2nd ed.: Leidæ, 1696. 4°.

— Natuurs verborgentheden ondekt, zynde een tweede vervolg der brieven geschreeven aan de Koninglyke Societeit tot London. Delphis Batavorum [Delft], 1689. pls. 4°. Pre-Linn. 1689.1

Contains data on structures of fishes.

— Ontledingen en ontdekkingen van onsigtbare verborgentheden. Leiden, 1691. figs. 4°. Pre-Linn. 1691.1

Contains data about the reproduction of fishes, and about the scales of eels.

— An extract of a letter . . . containing observations on . . . the gall, and scales of fishes . . . Phil. Trans. Roy. Soc. London, 1693 (1694), 17, 956–958. Pre-Linn. 1694.1

— Vierde vervolg der brieven geschreeven aan de wytvermaarde Koninglyke Societeit in London. Delphis Batavorum [Delft], 1694. figs. 4°. Pre-Linn. 1694.2

Contains data on reproduction of fishes.

— Arcana naturæ detecta. Delft, 1695. 4°. Pre-Linn. 1695.1

Reprints of letters to Royal Society of London dealing with reproduction and with circulation of blood in fish.

Second ed.: Leiden, 1722. 4°.

— Extract of a letter containing microscopical observations on eels, etc. Phil. Trans. Roy. Soc. London, 1696, 19, 269–280. Pre-Linn. 1696.1

Sexes and reproduction of eels, and circulation of blood in tails of eels.

— Continuatio arcanorum naturæ detectorum. Delft, 1697. 4°. Pre-Linn. 1697.1

Sexes of eels, circulation in eels, and scales of fishes.

2nd ed.: Leidæ, 1722. 4°.

— Sesde vervolg der brieven geschreeven aan verscheiden hooge stands-personen en geleerde luyden. Delphis Batavorum [Delft], 1697. figs. Pre-Linn. 1697.2

Contains data about various fishes.

— Letter concerning the spawn of codfish. Phil. Trans. Roy. Soc. London, 1701 (1702), 22, 821–824. Pre-Linn. 1702.1

Leeuwenhoek, A. v.

— Part of a letter from Mr. Lewen-
hoek, concerning the circulation and
globules of the blood in butts. *Phil.*
Trans. Roy. Soc. London, 1700 (1702),
22, 552-560. Pre-Linn. 1702.2

— A letter from Mr. Antony van
Leeuwenhoek, F. R. S., concerning the
flesh of whales, crystalline humour of the
eye of whales, fish and other creatures,
and of the use of the eye-lids. *Phil.*
Trans. Roy. Soc. London, 1704 (1706),
24, 1723-1730. Pre-Linn. 1706.1

— On the circulation of the blood
in fishes. *Phil. Trans. Roy. Soc. Lon-*
don, 1708 (1709), **26**, 250.

Pre-Linn. 1709.1

— On the circulation of the blood
in an eel. *Phil. Trans. Roy. Soc. Lon-*
don, 1708 (1709), **26**, 448-449.

Pre-Linn. 1709.2

— *Epistolæ ad Societatem Reg.*
Anglicanam & alios viros illustres datæ,
seu continuatio mirandorum arcanorum
naturæ detectorum XL epistolis conten-
torum. Lugduni, 1719. 4°.

Pre-Linn. 1719.1

"*Quædam de acipensere, gado, anguillæ &*
harengi generatione & de squamarum piscium
incremento ibi explicantur." — Walb.

— *Epistolæ physiologicæ. Delft,*
1719. 4°.

Pre-Linn. 1719.2

Scales of fishes.

— Observations on the muscular
fibres of fish. *Philos. Trans. Roy. Soc.*
London, 1721 (1723), **31**, 190-198.

Pre-Linn. 1723.1

— A letter to the Royal Society
concerning the particles of fat, trans-
lated from the Dutch by John Cham-
berlain. *Phil. Trans. Roy. Soc. London*,
1722 (1724), **32**, 93-99.

Pre-Linn. 1724.1

Microscopic structure of the fat of the plaice
and perch.

Two collections of Leeuwenhoek's works ap-
peared before his death (1723); one in Dutch,
Leiden & Delft, 1685-1718; the other in Latin,
Leiden, 1715-1722. A selection from the latter,
translated into English by S. Hoole, appeared
at London, 1798-1807.

Le Grand, Ant. [—1699] *Insti-*
tutio philosophiæ secundum principia
renati des cartes nova methodo exor-
nata & explicata. Londinii, 1680. figs.
4°.

Pre-Linn. 1680.1

— *Institutio philosophicæ. No-*
rimbergæ, 1683. 856 p. 8°.

Pre-Linn. 1683.1

Fishes, p. 398, 402, 520, 574-578. Copy,
Col.

Leguat, François [1638-1735] *Voy-*
age et aventures de F. Leguat . . . en
deux isles désertes des Indes orientales.
Avec la rélation des choses les plus re-
marquables qu'ils ont observées dans
l'isle Maurice, à Batavia, au cap de
Bonne-Espérance, dans l'isle St. Hélène
et en d'autres endroits de leur route.
2 vols. *Londres*, 1708. illust. 12°.

Pre-Linn. 1708.1

Fishes: vol. I, p. 10-12, 20-25, 121-123;
vol. II, p. 39-41. figs.

Other eds.: French, *London*, 1711, 1721;
German, *Frankfort & Leipsic*, 1709. Dutch
and English versions follow.

— *De gevaarlyke en zeldzame rey-*
zen van den Heere F. L. mit zyn byheb-
bend gezelschap naar twee onbewoonde
Oostindische eylanden. Utrecht, 1708.
xvi, 178 p. 4°.

Pre-Linn. 1708.2

— A new voyage to the East-Indies
by F. Leguat and his companions, etc.
London, 1708. viii, xv, 248 p. pls.
maps. 8°.

Pre-Linn. 1708.3

Easily available as reprint, Hakluyt Soc.,
Works, nos. 82 & 83, 1891.

Lehmann, Christian [1611-1688]
Historischer Schauplatz derer natür-
lichen Merkwürdigkeiten in den Meiss-
nischen Ober-Ertzgebürge. Leipzig,
1699. fig. 4°.

Pre-Linn. 1699.1

Describes the mammals, birds and fishes of
this region.

Another ed.: *Leipzig*, 1747. 4°.

— (*respond.*) *De carne piscium*
dissertatio. Hafniæ, 1714. 8 p. 4°.

Pre-Linn. 1714.1

Joh. Helsingius, *præses.*

Leigh, Charles [1662-c.1701] *The*
natural history of Lancashire, Cheshire,
and the peak of Derbyshire, etc. Ox-
ford & London, 1700. 25 pls. fol.
map.

Pre-Linn. 1700.1

Fishes, p. 130-147.

Le Maire, — (*Sieur*) *de. Les voy-*
ages aux îles Canaries, Cap-Verd, Séné-
gal, et Gambie. Paris, 1695. 8°.

Pre-Linn. 1695.1

Much data about fishes.

There is a much abridged English version by
Edmund Goldschmid, *Edinburgh*, 1887.

Le Marie, — *Observation sur un*
poisson de mer des Indes, nommé lézard
d'eau. Mém. Acad. Sci. Paris, 1751,
hist., 36.

Pre-Linn. 1751.1

Lemery, Nicolas [1645-1715] *Mod-*
ern curiosities of art and nature. Ex-
tracted out of the cabinets of the most
eminent personages of the French court

. . . made English, from the original French. London, 1685. 12°.

Pre-Linn. 1685.1

Data on fish and fishing.

Another issue: London, 1711, translated from the 7th ed. (in French). Original not known.

Lemnius, Levinus [1505–1568] *De occultis naturæ miraculis libri II*. Antwerp, 1559. 12°. Pre-Linn. 1559.1

Some data on fishes, — remora & others.

The first issue of a work which ran through a large number of editions. Twenty-two of these are known, including 6 at Antwerp & 5 at Frankfort. Among them are versions in Italian (1560), Dutch (1588), German (1593), & English, 1658. Two of these are:

— *Occulta naturæ miracula*. Wunderbarliche Geheimnisse der Natur in des Menschen Leib und Seele, auch in vielen andern natürlichen Dingen, als Steinen, Ertzt, Gewächs und Thieren. Aus dem Latein in Teutsche Sprach gebracht, zum dritten Mal vermehrt, und eines grossen Theils vom Neuen selbst geschrieben durch Jacobum Horstium. Leipzig, 1593. 2 vols. 4°.

Pre-Linn. 1593.1

— Concerning the secret miracles of nature. London, 1658.

Pre-Linn. 1658.1

Copy, L. C.

Léry, Jean de [1534–1611] *Histoire d'un voyage faict en la terre du Brésil, autrement dite Amérique*. Contenant la navigation, et choses remarquables, veües sur mer par l'auteur . . . Les meurs et façons de vivre estranges des sauvages Américains, &c. Rouen, 1578. 8°.

Pre-Linn. 1578.1

Contains (in pt. 12) earliest descriptions of Brazilian fishes.

The rare 1st ed. This work passed through eds. in French; Geneva, 1580, 1600, & 1611; La Rochelle, 1585; Paris, 1580, 1585, 1586, 1594 & 1600. Latin eds. are: Geneva, 1586 (1st), 1587, 1594, 1600, 1677; German, Frankfort, 1594. It was also reprinted in De Bry. *America*, pt. III. Latin, 1592; and in Arkstee & Merkus. *Allg. Hist. Reisen*, Bd. XVI, 1758. Extracts are also found in "Purchas his Pilgrimes." 1625, vol. IV, p. 1325.

— *Historia navigationis in Brasiliam, qua et America dicitur, qua describitur . . . Brasiliensium mores . . . cum eorum linguæ dialogo, animalia etiam, arbores atque herbæ, etc.* Genevæ, 1586. pl. 8°. Pre-Linn. 1586.1

— *Historie van een reyse ghedaen in den lande van Bresillien, andersins ghenoeemt America, etc.* Amsterdam, 1597. 214 leaves. figs. 8°.

Pre-Linn. 1597.1

L'Escluse, Charles. See **Clusius, C.**

Le Tellier, Pet., & Ronaudot, Eus. *Non ergo licet citra sanitatis dispendium bis in piscibus satiari*. Paris, 1639.

Pre-Linn. 1639.1

From Boehmer. Not seen.

Le Vasseur, Claud, & Cousin, Jo. See **Cousin & Le Vasseur**.

Leyser, Aug. *De piscatione*. Helmstadt, 1727. 4°. Pre-Linn. 1727.1

Lhuyd, Edward. See **Luid, Edward**.

Libavius, Andreas (*præses*) [c. 1560–1616] *Dissertatio de jure thesaurorum inveniendorum, deque respiratione piscium, testatorum, crustatorum, molium et insectorum*. Coburg, 1609. 4°. Pre-Linn. 1609.1

Georgius Katzbeccius, *respond.*

Lichtensteger, G., & Eisenberger, N. F. See **Eisenberger & Lichtensteger** (*editors*).

Liger, Louis [1658–1717] *Oeconomie générale de la campagne, ou nouvelle maison rustique*. 2 vols. Paris, 1700. 4°.

Pre-Linn. 1700.1

Other eds.: Paris, 1701 & 1708. Liger's work appears also as the following:

— *Amusemens de la campagne, ou, nouvelles ruses innocentes . . . avec les plus beaux secrets de la pêche dans les rivières et étangs; et un traité général de toutes les chasses*. 2 vols. Paris, 1709. xx, 486 & viii, 518 p. illust. 12°.

Pre-Linn. 1709.1

Other editions appeared with varying titles containing essentially the same material. Some follow.

— *Le ménage de la ville et des champs, et le jardinier françois . . . avec un traité de la chasse et de la pêche, etc.* Bruxelles, 1712. 12°.

Pre-Linn. 1712.1

Chaps. xvii, xviii, xix contain "Traité de la pesche."

New ed., enlarged: Paris, 1720.

— *Nouveau théâtre d'agriculture ou ménage des champs, et de la ville avec un traité de la chasse et de la pêche*. Bruxelles, 1712. 8°.

Pre-Linn. 1712.2

"La pesche," chap. xxxv.

Other eds.: Paris, 1713, 1723, 1732, 1755.

— *Traitté de toute sorte de chasse de pêche*. Contenant la manière de faire, racommoder et teindre toutes sortes de filets . . . avec les plus beaux

Liger, L.

secrets de la pêche, dans la mer, les rivières et les étangs; et un dictionnaire de tous les termes de filets, de chasse et de pêche, employez dans ce livre. 2 vols. Amsterdam, 1714. xvi, vi, 614 p. 70 pls. 12°. Pre-Linn. 1714.1

— La nouvelle maison rustique, ou économie générale. 2 vols. Paris, 1721. 4°. Pre-Linn. 1721.1

This compilation superseded "La maison rustique" of Charles Estienne. Under the above or slightly varying titles there are at least 11 editions running as late as 1792.

— Amusemens de la chasse et de la pêche . . . Avec . . . les plus beaux secrets de la chasse et de la pêche; la manière de faire les rets et les filets, etc. 2 vols. Amsterdam & Leipzig, 1743. 12°. Pre-Linn. 1743.1

This is essentially a version of 1714.1

Liger was the Gervase Markham of his day, and his very popular work, dealing in part with fishing and fish ponds, passed through a large number of editions. Since the title was frequently changed, it has been necessary to indicate the various editions somewhat fully.

Ligon, Richard [*fl.* 1650] A true and exact history of the island of Barbadoes. London, 1657. 122 p. pls. fol. Pre-Linn. 1657.1

Fishes, pp. 3-6, 35-36, 39. A French version in a French collection of voyages to Africa and America is:

— Histoire de l'isle des Barbades. Paris, 1684. 4°. Pre-Linn. 1684.1

Lindblad, Gust. (*respond.*) Dissertatio de causis diminutionis piscium. Aboæ, 1757, 9 p. 4°. Pre-Linn. 1757.1
Petr. Kalm, *præses*.

Linden, Jan Antonid van der [1609-1664] *Asellus lucius*. (In *Selectis Medicis*. Amsterdam, 1656, 363. 4°.) Pre-Linn. 1656.1

Linnæus, Carl von [1707-1778] For biographies, see Hillhouse, W. 1907.1; and Rendle, A. B. 1907.1. For an extensive list of his works and of critical essays on the man and his influence on the development of natural history, see Catalogue British Museum (Natural History). London, 1910, vol. III, 1125-1150. See also Linnæus, C., in vol. I.

— Systema naturæ, sive regna tria naturæ systematice proposita per classes ordines, genera, & species, etc. Lugduni Batavorum, 1735. 14 p. gr. fol. Pre-Linn. 1735.1

145 species of fishes enumerated in 36 genera. Other editions of this epoch-making work are:

2nd. Stockholm, 1740. 80 p. 8°.

3rd. Halle, 1740. iv, 70 p. obl. 4°.

4th. Paris, 1744. 108, xxvi p. 8°.

5th. Halle, 1747. 88 p. 8°.

6th. Stockholm, 1748. ii, 224, 27 p. 8 pls. 8°.

7th. Leipzig, 1748. iv, 224, 30 p. 8 pls. 8°.

8th. Stockholm, 1753. iv, 136, 16 p. 3 pls. 8°.

9th. Leyden, 1756. viii, 227, 26 p. 8 pls. 8°.

10th. Stockholm (2 vols.), 1758-59. ii, 1384 p. 8°.

The 10th ed., the international date line in zoology, has been often reprinted, in whole or in part, in various languages. For full title, see Linnæus, C. 1758.2.

— De glutine Lapponico (ex *Perca præparando*) König. Schwed. Akad. Abhandl., 1739, 1, 261. Pre-Linn. 1739.1

— Beschreibung von Gold- und Silberfischen. König. Schwed. Akad. Abhandl., 1740, 2, 175-184. Pre-Linn. 1740.1

See note under Kästner, A. G. Pre-Linn.

— Beskrifning om guldfisken och silverfisken. K. Svensk. Vetensk. Akad. Handl., 1740, 2, 403. — *Mélanges Hist. Nat.* Dulac, 1740, 1, 13-25. — *Hamburg. Gel. Ber.*, 1764, 756-761. Pre-Linn. 1740.2

See also Linnæus, C. von. Add. 1762.1

— *Cyprinus pinnæ ani radiis 11, pinnis albescentibus, Staem suecis, descriptus* [*Cyprinus grislagine*]. *Acta Reg. Soc. Sci.*, Upsal., 1744-50, 35-36. 3 pls. Notice in *Comment. Lips.*, 1, 578. Pre-Linn. 1744.1

— Öländska och Gothländska Resa . . . förrättad åhr 1741. Med anmärkingar uti . . . *Natural-Historien*, etc. Stockholm & Upsala, 1745. xii, 344, 30 p. ill. Pre-Linn. 1745.1

Various fishes are described.

A German version (Schreber trans.), Halle, 1764 & 1774; Dutch, Dordrecht, 1780. Abridged editions were later issued as, "Gothländska Resa," etc. Visby, 1890, and "Öländska Resa," etc. Stockholm, 1907.

— Fauna Suecica sistens animalia Sueciæ regni: quadrupedia, aves amphibia, pisces, . . . distributa per classes & ordines, genera & species. Cum differentiis specierum, synonymis auctorum, nominibus incolarum, locis habitationum, etc. Stockholmia, 1746. 14 leaves. 411 p. 2 pls. 8°. Pre-Linn. 1746.1

Other eds.: Leyden, 1746; Stockholm, 1761; & Leipsic, 1800.

A preliminary list of animals observed by Linnæus in Sweden appeared in "*Acta Lit. & Sci. Sueciæ*," 1736, 4, 97-138. It was reprinted in "*Oratio de necessitate peregrinatorum intra patriam*," Leyden, 1743. Not seen and not known to contain fishes.

— Wästgöta-Resa . . . Förrättad år 1746. Med anmärkningar uti . . . Naturkunnogheten, etc. Stockholm, 1747. xii, 284, 19 p. 5 pls. 8°. Pre-Linn. 1747.1

Balistes guaperva chinensis figured.
German version by Schreber, Halle, 1765.

— Amœnitates academicæ, seu dissertationes variæ . . . collectæ et auctæ, etc. Lugduni Batavorum, 1749, vol. I. iv, 610, 9 p. 15 pls. Pre-Linn. 1749.1

In this vol. (I) occur papers (Linnæus, *præses*) by Balk, & Sundius, listed under their names elsewhere.

Dissatisfied with this edition, Linnæus had another prepared, in which the several theses were arranged in chronological order, which appeared as a 2nd ed., Leipsic & Stockholm, 1749. A 3rd ed. appeared, Erlangen, 1787.

— Skånska Resa . . . Förrättad år 1749. Med rön och anmärkningar uti . . . naturalier, etc. Stockholm, 1751. xiv, 434 p. 6 pls. 8°. Pre-Linn. 1751.1

Cyprinus cultratus & *Gadus merlangus* figured.
An abridged German ed. is:

Versuche einer Natur-Kunst- und Oeconomie-Historie von einigen Schwedischen Provinzen, übersetzt von C. E. Klein. Stockholm & Leipzig, 1756. 8°.

— Pisces (In his Museum S. R. M. Adolphi Friderici Regis Suecorum . . . in quo animalia rariora imprimis et exotica . . . describuntur et determinantur, Latine et Suecice, etc. Holmiæ, 1754. 133 p. 32 pls. fol.) Pre-Linn. 1754.1

89 fishes are figured and described. Contains earliest known figure and description of catfish egg and embryo (*Ascita ventricosa*), p. 79.

Copies, A. M. N. H., & P. I.

A previous catalogue of these specimens by L. Balk appeared as a thesis, Holmiæ, 1746, 48 p. 2 pls.; and in *Amœnitates Academicæ*, 1749, 1, 556–610. (See Balk, L., 1749.1).

For later works of Linnæus, see in Vol. II.

Linocier, Geoff. [c. 1550–c. 1620] *L'histoire des plantes, traduite de Latin (of Du Pinet) en Françoise . . . à laquelle sont adioustées celles des simples aromatiques, animaux à quatre pieds, oiseaux, poissons, serpens, & autres bestes venimeuses (receuilles de Gesnerus & autres bon approuvez auteurs) . . . etc.* Paris, 1584. 593 p. 12°. Pre-Linn. 1584.1

Other eds.: 1619–20 (2nd), 8°; & 1622. 16°, with woodcuts.

Linschoten, Jan Huygen van [1563–1611] *Itinerario, voyage ofte schipvaert van J. H. van Linschoten naer oost ofte Portugaels Indien, inhoudende*

een corte beschryvinge der selver landen ende zee-custen. Amstelredam, 1595–96. viii, 160 leaves. pls. maps. fol. Pre-Linn. 1595.1

Remora as a ship-holder. Indian fishes described.

This seems to be the *editio princeps*. Other eds. are: Amsterdam, 1605, 1614, 1623 and 1644; 1660–70. Various versions follow:

— J. Huighen van Linschoten, *His discours of voyages into ye Easte and West Indies, in foure bookes.* London, 1598. 462 p. fol. Pre-Linn. 1598.1

Book I, chap. XLVIII, Remora as a ship-stopper. Fishes in the seas of India.

Most available for present-day English readers as: "The voyage of J. Huyghen van Linschoten to the East Indies . . . edited (with introduction) by . . . P. A. Tiele. Hakluyt Society, Works, no. 71, 1885."

— *Navigatio ac itinerarium J. H. Linscotani in Orientalem sive Lusitanorum Indiam. Descriptiones ejusdem terræ . . . etc.* The Hague & Leyden, 1599. fol. Pre-Linn. 1599.1

— *Histoire de la navigation de Jean Hugues de Linscot Hollendois et de son voyage en Indies Orientales, etc.* Amstelredam, 1610. ii, 275 leaves. fol. Pre-Linn. 1610.1

Two other French eds. at Amsterdam, 1619.

Various editions of Linschoten's works in N. Y. P. For collations of these and other works by Linschoten, see Thiele, P. A. *Nederl. Bibliog. Land-en-Volken Kunde.* Amsterdam, 1884.

For a modern Dutch version of the above work by Linschoten, together with a bibliography of his writings, see the 2 vol. edition issued by the Linschoten-Vereeniging at The Hague in 1910, under the editorship of Dr. H. Kern.

Lipenius, M. Mart. *Dissertatio Ionæ diaplus Thalassius, in qua de pisce Ionæ portatore.* Wittebergæ, 1678. 4°. Pre-Linn. 1678.1

Lipstorp, D. Dan. (*præses*) *Dissertatio de iure venationis et aucupii.* Upsaliæ, 1663. 4°. Pre-Linn. 1663.1
Jo. G. Salenius, *respond.*

Lister, Martin [c. 1638–1712] *Observations and experiments made for the Royal Society.* Phil. Trans. Roy. Soc., 1674, 9, 221–226. Pre-Linn. 1674.1

Tricuspid shark's teeth lacking serrations, p. 223.

— Pisces (in) *Appendix ad historiam naturalem piscium.* (In Wilughby, F. *De historia piscium, etc.* Oxonii, 1686. fol. ills.) p. 19–27. Pre-Linn. 1686.1

Lloyd, Edward. See **Luid, Edward.**

Lochner von Hummelstein, Johann Heinrich [1662–1720] *Rariora musei Besleriani, quæ olim Basilius et Michael Rupertus Besleri collegerunt, ænisque tabulis ad vivum incisis evulgerunt, nunc commentariolo illustrata a Johanne Henrico Lochnero, . . . de novo luci publicæ commisit Michael Fridericus Lochner. Norimbergæ, 1716. xxiv, 112 p. 41 pls. Pre-Linn. 1716.1*

Seven fishes figured and described, p. 55–68. Fossil fishes, p. 93–94. Glossopetras, p. 105. Copy, A. M. N. H.

The contents of the Museum were collected and were figured on copper by B. and M. R. Besler and the descriptive text written by J. H. Lochner von Hummelstein. See also Besler, B. & M. R.

Locke, J. An extract of a letter written to the publisher by Mr. J. L. about poisonous fish in one of the Bahama islands. *Phil. Trans. Roy. Soc., 1675, 10, 312. Pre-Linn. 1675.1*

Poisoning from eating Barracuda.

Lodewijksz, G. M. A. W. *D'eerste boeck. Historie van Indien, waer inne verhaelt is de avontueren die de Hollandsche schepen bejeghent, etc. Amstelredam, 1598. obl. 4°. Pre-Linn. 1598.1*

Fishes, chap. xiv with pl. Methods of fishing at Gammelaume.

Other & identical eds.: 1609, 1617. French & Latin versions follow:

— *Premier livre de l'histoire de la navigation aux Indes Orientales par les Hollandois, etc. Amstelredam, 1598. 54 pls. fol. Pre-Linn. 1598.2*

Chap. xiv, flying fishes, sharks, remoras, albicores, etc., described. Plate showing fishes, p. 16.

Another ed., Amsterdam, 1601.

— *Prima pars descriptiones itineris navalis Indiam orientalem, etc. Amstelredami, 1598. fol. Pre-Linn. 1598.3*

Chap. xiv, flying and other fishes. fig.

Another ed., Amsterdam, 1614. Copies of all the above, N. Y. P.

The same data is contained also in Neck, J. C. 1598.1, this section.

Löwe, — von. *Von den Räubern der Karpfenbrut. Samml. Nat. u. Med. Kunst. u. Litt.-Gesch. Breslau, 1718, 4. Vers., 1222. Pre-Linn. 1718.1*

Lonicer or Lonitzer, Adam [1528–1586] For a sketch of his life, see Roth, F. W. E., in *Centralb. für Bibliothekswesen*, 1902, 19. Jahrg., 277–281.

— *Naturalis historiæ opus novum, in quo tractatur de natura et viribus arborum, fruticum, herbarum, animantiumque terrestrium, volatilium et aqua-*

tilium, etc. 2 vols. Francofurti, 1551–55. 706 p. 50 pls. fol.

Pre-Linn. 1551.1

“A work more remarkable for its longevity than its quality.” — Miall.

Much of Lonicer's material came from J. von Cube.

The 2nd vol. apparently contains plants only.

— *Kräuterbuch nächst Beschreibung der fürnehmsten Thiere, . . . Fischen, . . . &c. Francofurti, 1546. fol. Pre-Linn. 1546.1*

This work, apparently a German translation of the preceding, passed through many eds.: Nuremberg, 1628, & 1678; Augsburg, 1713; Ulm, 5 eds., 1570–1770; & at Frankfurt, 13 eds. between 1546 & 1650. The last ed., Ulm [or Augsburg], 1783. fol.

Lonicer, Johann Adam. *Venatus et aucupium, iconibus ad vivum expressa, et succinctis versibus illustrata. Francofurti, 1582. 4°. Pre-Linn. 1582.1*

With 40 plates, by Jost Amman, of hunting, hawking, fishing, fowling, etc.

Lonitzer, Adam. See **Lonicer, Adam.**

Lorenzini, Stefano. For a historical note on Lorenzini and on our knowledge of the Torpedo, see Boll, Franz. 1874.1.

— *Osservazioni intorno alle torpedini. Firenze, 1678. 136 p. 4°. figs. Pre-Linn. 1678.1*

— *De anatomia torpedinis. Ephemer. Acad. Nat. Cur., 1678–79 (1693), 2. dec., ann. 9 & 10, 389–395. Pre-Linn. 1693.1*

— *De linguis piscium. Ephemer. Acad. Nat. Cur., 1678–79 (1693), 1. dec., ann. 9 & 10, 406–408. Pre-Linn. 1693.2*

— *De vi stupefactiva torpedinis ex ejusdem osservazioni intorno alle torpedini excerptum. Misc. Acad. Nat. Cur., 1678–1679 (1693), dec. 1, ann. 9 & 10, 395–406. Pre-Linn. 1693.3*

— The curious and accurate observations on the dissections of the cramp-fish, done into English by J. Davis. London, 1705. 75 p. 5 pls. 4°. Pre-Linn. 1705.1

— *Descriptio anatomica torpedinis. (In Valentini, M. B. Amphitheatrum Zootomicum, Francofurti, 1720, pt. II, 110–115. pl.) Pre-Linn. 1720.1*

A post-Linnæan version is:

Beschreibung und Zergliederung der Kramp-froschen. (In Schneider, J. G. Sammlung von anatomischen Aufsätzen und Bemerkungen zur Aufklärung der Fischkunde. Leipzig, 1795. Th. 1.)

Lovell, Robert [1630–1690] *Panzoo-logicomineralogia. Or a compleat history of animals and minerals, containing the summe of all authors, both ancient and modern . . .* Oxford, 1661. xvi, 519, 152 p. 8°. Pre-Linn. 1661.1

Fishes named, structure and action given, in introduction. Fishes of England and their uses, in introduction. *Ichthyologia*. p. 185–232. Fishes used as food or medicine, p. 232–241. Copy, Col.

Low, Johannes. Eine art, die Fischottern lebendig zu fangen, und sie abzurichten dass sie Fische bringen. *König. Schwed. Akad. Abhandl.*, 1752, **13**, 147. Pre-Linn. 1752.1

See note under Kästner, A. G. See also Low, J.. Add. 1762.1.

— Sätt at fänga uttrar lefvande och inrätta dem, at bära hem fisk. *K. Svensk. Vetensk. Acad. Handl.*, 1752, **13**, 139–149. Pre-Linn. 1752.2

— Konst om de otters levendig te vangen tam te maaken, en zo af te rigten dat zy visch aanbrengen. *Uitgez. Verh.* 1757, **2**, 61–69. Pre-Linn. 1757.1

Ludolf, Hiob [1624–1704] *Historia Aethiopica, sive descriptio regni Habessinorum, etc.* Frankfort, 1681. fol. Pre-Linn. 1681.1

Book II, chap. XI, contains a reference to a fish called "Torpedo," presumably *Malopterurus*. If correctly identified, this is probably the earliest known reference to this fish.

Versions in other languages are:

— A new history of Ethiopia. Being a description of the kingdom of

Abessinia . . . wherein are contained . . . ; their birds, beasts, amphibious animals . . . serpents, etc. London, 1682. viii, 398 p. 9 pls. 4°. Pre-Linn. 1682.1

— Nouvelle histoire d'Abissinie ou d'Ethiopii. Paris, 1684. figs. 8°. Pre-Linn. 1684.1

— Nieuwe doch aanmerkenswaardige historie van Abissinien andersints Ethiopien, etc. Utrecht, 1687. 220 leaves. 4°. Pre-Linn. 1687.1

Luid, Luyd, Lhuyd, or Lloyd, Edward [c. 1660–1709] *Epistola; in qua agit de lapidibus aliquot perpetua figurâ donatis, quos nupires annis in Oxoniense & vicinis agris adinvenit.* *Phil. Trans. Roy. Soc.*, 1693, **17**, 746–754. Pre-Linn. 1693.1

Bufonites, ichthyospondylas, and glossopetras (fossil sharks' teeth), p. 749–754.

— *Lithophylacii Britannici ichnographis, sive lapidum aliorumque fossilium Britannicorum singulari figura insignium; etc.* Londini, 1699. 23 pls. 8°. Pre-Linn. 1699.1

Fossil sharks' teeth and fishes' jaws. 2nd. ed., 1760.

Lund, Carl Frid. Neue Art, einen Canal oder Fischteich mit verschiedener Gattung Fische anzufüllen. *Brem. Magaz.*, 1757, **1**, 2. St., no. 61. Pre-Linn. 1757.1

Luyd, Edward. See **Luid, Edward.**

M

Maffei, Scipio [1675–1755] For a sketch of his life and a collection of his letters, see Pindemonte, V. "Elogi di Letterati." Verona, 1825–26, vol. I.

— Della formazione de' fulmini. Trattato raccolto da varie sue lettere; in alcune delle quali si tratta anche degli insetti rigenerantisi, e de' pesci de mare su i monti, e più a lungo dell' elettricità. Verona, 1747. pls. 4°.

Pre-Linn. 1747.1

"Come siano andate su le montagne i marini testacei, e i pesci di mare, che impietriti si scoprono ne' macigni. Lettera al Sig. De La Condamine." — Dal Nero.

— Brief von versteinerten Muscheln und Fischen, die in den Bergen gefunden werden. Nord. Beitr., 1757, 1, 1–22.

Pre-Linn. 1757.1

— Gedanken von Blitz, Insekten und verschiedenen Seefischen auf den Bergen. Leipsic, 1758. 8°.

Pre-Linn. 1758.1

German version of "Della formazione."

For works of Maffei published after 1758, see Maffei, S., 1795.1.

Magalhanes de Gandavo, Pedro de [1540–] Histoire de la province de Santa Cruz, que nommons ordinairement le Brésil. Lisbon, 1576.

Pre-Linn. 1576.1

Fishes, chap. 8.

Available today in Ternaux, Henri. "Voyages, relations et mémoires originaux pour servir à l'histoire de la découverte de l'Amérique, publiés pour la première fois en français." Paris, 1837, p. 91–99.

Magnus, Olaus [c. 1490–1568] Historia de gentibus septentrionalibus earumque diversis statibus, conditionibus, moribus, ritibus, superstitionibus. Romæ, 1555. figs. 4°.

Pre-Linn. 1555.1

Lib. xx. De piscibus et de piscatione; de Halece sive arenga; Lib. xxi. De piscibus monstrosis: p. 697–778.

1st ed. Others: (full text) Venice, 1565 (Italian); London, 1658 (English); Amsterdam, 1599 & 1665 (Dutch); 1652, 1699 (Latin); Strassburg, 1667 (German): (abridged form) Antwerp, 1558 & 1562; Paris, 1561 (French); Basel, 1567; Amsterdam, 1586; Frankfort, 1618; Leiden, 1652 (Latin). Three of these eds. are:

— Historia delle genti et della natura delle cose settentrionali. Venice, 1565. Pre-Linn. 1565.1

— De wonderlycke historie der noordersche landen, beschreven door Olaus de Groote. Ook after aen by ghevoecht verscheyden waerchtige navigatien tegent noorden ghedaen by onsen tyt, als op Nova-Zembla, Groenland en door de Strate van Nassouwen anders Weygats ghenamt. Amsterdam, 1599. 4°.

Pre-Linn. 1599.1

Fishes, books 21 & 22.

— A compendious history of the Goths, Swedes and Vandals and other northern powers. Translated by J. S. Powers. London, 1658. fol.

Pre-Linn. 1658.1

"Whatever Olaus Magnus, titular Archbishop of Upsala, may have been as a describer of national customs and a collector of folklore, he sinks to the mediæval level in his descriptions of animals." — L. C. Miall.

Major, D. B. Unvorgreiffliches Bedencken von Kunst- und Naturalien-Kammern insgemein. (In Valentini, M. B., Museum Museorum, oder vollständige Schau-Bühne aller Materialien und Specereyen, . . . etc. Franckfurt-am-Mäyn, 1704. 76 p. fol.)

Pre-Linn. 1704.1

Fossil shark's teeth figured and described, p. 58.

2nd ed., 3 pts.: Frankfort, 1714.

Major, Johannes Henry. Brevis & accuratæ historiæ animalium in sacro cumprimis codice commentatorium libri II. Francofurti & Spiræ, 1685. 8°.

Pre-Linn. 1685.1

Jonah and the shark.

See also Pfeiffer, S. A. in this section.

Malm, Nicolas (respond.) Ichthyothelogiæ primæ lineæ. Inaug. Dissert. Aboæ, 1751. 37 p. 4°.

Pre-Linn. 1751.1

Carl Fred. Menander, præses.

Malpighi, Marcello [1628–1694] For sketches of his life and work, see Locy, W. A. 1908.1 (p. 58–67); & Pop. Sci. Mo., 1901: also Miall, L. C. 1912.1 (p. 145–166).

— Opera omnia. 2 vols. Londini, 1686. fol. Pre-Linn. 1686.1

The above are often found collected in one or two volumes. They were reprinted without editing and the pagination is not continuous, so that reference is troublesome. In one of the author's contributions, the optic nerve of the swordfish is described.

Another ed., Leyden, 1687 (2 vols. in 1). Posthumous eds.: London, 1697, & Amsterdam, 1698.

Manardi, Giovanni [1462–1536] *De Silurus antiquorum dissertatio*. Ferrara, [c. 1560] Pre-Linn. 1560.1

"Cited by Conrad Gesner, in his 'Fischbuch,' as having identified the Glanis of ancient writers with the Danube catfish known in modern nomenclature as *Parasilurus glanis*. The form is illustrated by Gesner, and also, according to Killermann, in the manuscript work of Petrus Candidus, written in 1460." — C. R. Eastman.

Mandelslo, Johann Albrecht [1616–1644] *Beschryving van den gedenkwaerdige zee- en land-reyze deur Persien naar Oost-Indien, etc.* Amsterdam, 1658. viii, 150 leaves. 4°. Pre-Linn. 1658.1

This celebrated work, first published at Schleswig in 1645, passed through a number of editions. Some are (German) Schleswig, 1645, 1647, 1658; (Dutch) Amsterdam, 1651 & 1659; (English) London, 1696; (French) Leyden, 1719 & 1727. It was also reprinted in Arkstee & Merkus, *Allg. Hist. Reisen, etc.* 1753, XI, under the title "Reise nach Indostan."

— The voyages and travels of J. A. de Mandelslo . . . into the East Indies (In Olearus, Adam. The voyages and travels of the Ambassadors sent . . . to the great duke of Muscovy, and the king of Persia, etc. London, 1662. 4°.) Pre-Linn. 1662.1

— *Morgenländische Reise-beschreibung*, herausgegeben durch A. Olearium mit desselben Anmerkungen. Hamburg, 1696. 174 p. fol. Pre-Linn. 1696.1

— *Voyages célèbres et remarquables faits de Perse aux Indes Orientales; contenant une description nouvelle et très curieuse de l'Indostan, de l'Empire du Grand-Mogol, des îles et presque îles de l'Orient, des royaumes de Siam, du Japon, du Congo, de la Chine, etc.* 2 vols. [in 1] Leide, 1713. pls. maps. fol. Pre-Linn. 1713.1

Fishes, p. 88, 209, 280, 464, 559, 573, 619, 620–621, 623, 627, 634, 670, 673, 675, 684.

Mandeville, [Bernard] 1670–1733] *Zoologia medicinalis hibernica, or A treatise of birds, beasts, fishes, reptiles and insects, giving an account of their medicinal virtues*. Dublin, 1739. 8°. Pre-Linn. 1739.1

Another ed.: London, 1744.

Mandeville, (Sir) John (pseudon.) [c. 1350] For bio- and bibliographical data about the compiler who wrote under this name and about his book of travels, see article in *Encyclopædia Britannica* (11th ed.) 1911, vol. XVII, by E. W. B. Nicholson & Henry Yule; also A. Boven-schen's "Untersuchungen über Johann von Mandeville und die Quellen seiner Reisebeschreibung" in *Zeitschr. Ges. Erdkunde*, Berlin, 1888, Bd. xxiii, Heft. 3 & 4.

Other authoritative articles are that by G. F. Warner in the *Dictionary of National Biography*; and John Ashton's introduction to the modern ed. listed below. Ashton also gives lists of MS. and printed editions.

— Ce livre est appelle mandeville et fut fait et compose par monsieur jehan de mandeville chevalier natif d'angle-terre de la ville de saint alein, etc. 1480. fol. Pre-Linn. 1480.1

Thought to be the earliest dated copy.

— *Itinerario*. Explicit Johannes de Mandeville militis. Mediolani, 1480. 4°. Pre-Linn. 1480.2

— *Itinerarius Domini Johannis de Mandeville militis*. [n. p., n. d. (c. 1480)]. Pre-Linn. 1480.3

These are believed to be the first eds. in Italian and Latin. Ashton lists 21 eds. ante 1500; 17 in the 16th, and 10 in the 17th centuries, 12 from 1700–1742, and 17 from 1760–1881. The oldest English version seems to be:

— The boke of John Maunduyle Knyght of wayes to Jerusalem and of marvels of ynde and of other countries. [n. p., n. d.]

Printed by Pynson between 1493 & 1499. A modern English reprint of this is:

The voiage and travayle of Sir John Maundeville Knight, etc. London, 1887. 289 p. ills. 12°.

Edited by John Ashton with facsimile reproductions of many old figures. For the latest English version known to us, see Mandeville, Sir J. 1915.1.

Mandeville gives brief accounts of fish and fishing in the various countries visited — earliest account of fishing with the otter, among others (chap. LIII).

Mangolt, Gregory [1497–] *Fischbuch von der Natur und Eigenschafft der Vischen, insonderheit deren so gefangen werdend im Bodensee und in andern Seen und Wasseren. Item wie man Fisch und Vögel fahen solle*. Zürich, 1520. 70 p. 12 pls. Pre-Linn. 1520.1

There are also editions of "Fischbuchs" of 1557, 1576, 1578, & 1598, all at Zurich and all credited to Mangolt. The last is probably the best edition. The full title is:

Mangolt, G.

— Fischbuch von der Natur und Eigenschaft der Fischen, insonderheit deren so gefangen werden im Bodensee, und gemeinlich auch in anderen Seen und Wassern, durch den wohlgelehrten Gregorium Mangolt beschrieben, vormals nie gesähen. Item ein ander Büchlin wie man Fisch und Vögel fahen solle, mit dreyssig neuen und bewärten Recepten. Auch zu was Zeyten im gantzen Jar ein yeder Fisch am besten seye. Zürich, 1598. figs.

Pre-Linn. 1598.1

Maplet, John [—1592] A greene forest, or a natural historie, wherein may bee seene the most sufferaigne vertues in all the whole kinde of stones and mettals; of brute beastes, fowles, fishes, &c. London, 1567. 112 leaves. 12°. (*black letter.*) Pre-Linn. 1567.1

Maraldi, Jas. Phil. [1665–1729] (Remarks on fossil fishes from Mt. Lebanon, Syria, Sicily and Monte Bolca, Italy.) Mém. Acad. Sci. Paris, 1703 (1720), hist., 22–24. Pre-Linn. 1720.1

Marcellus Sidetes (*fl.* 135) Iatrica de piscibus, græce et latine, per Fed. Morellum sub tit.: De remediis ex piscibus. Paris, 1591. 4°. Pre-Linn. 1591.1

— (Fragmentum de piscibus) (With Oppian's "Poemata de venatione et piscatione," etc. Argentorati [Strasburg], 1680). Pre-Linn. 1680.1

— (Medicina ex piscibus) (In Jo. Alberti Fabricii Bibliotheca Græca, sive notitia scriptorum veterum Græcorum, etc. Accessit . . . Marcelli Sidetæ carmen de medicamentis è piscibus, Græce & Latine, cum brevibus notis. Hamburgi, 1705.) Pre-Linn. 1705.1

Medicine from fishes, p. 14–20. Latin and Greek on opposite pages, 101 lines. About 75 fishes are named and 2 are specified as follows: "De usu mulli in iis qui carbunculo laborant," "De pastinaca & aliis remediis adversus læsionem serpentis marini, aliaque."

An earlier ed., Hamburg, 1704; a later:

— De medicina ex piscibus, fragmentum poëmatis interprete Fed. Morello, Paris. Professore Regio. (In Jo. Alberti Fabricii Bibliothecæ Græcæ. Hamburgi, 1726, vol. XIII, 317–320.) Pre-Linn. 1726.1

Bio- and biblio-graphical data on Sidetes, p. 315–316.

Also found in modern form in Kühn, C. G. (præses):

Collectanea de Marcello Sideta I–V. Leipsic, 1834–35. 60 p. 4°.

Copy of this collection of 5 theses by students of Kühn in Surg. Gen. Lib.

Marcgrave, George [1610–1644] His name is also spelled Markgrave, Marggrave, Margrave, Markgraf, Marggraf, Marcgraf, etc. For an account of the life and work of Marcgrave, and for a full bibliography of Marcgrave material, see Gudger, E. W. "George Marcgrave, the first student of American natural history," Pop. Sci. Monthly, 1912, 73, 250–274; — Zool. Annalen (W. Breitenbach, trans.), 1914, 6, 1–31; also "George Marcgrave, a postscript" Science, 1914, n. s. 40, 507, by the same author; and Zaunick, Rudolph. "Nachtrag zu Gudger's Arbeit über Georg Marcgrave," Zool. Annalen, 1919, 7, 193–195.

— Brasilianische Naturgegenstände, (Collectio rerum naturalium Brasiliæ) [c. 1643] Pre-Linn. 1643.1

These water-color drawings of the animals and plants of Brazil, made by Marcgrave, are preserved in the great library of Berlin, labelled "Libri Picturati A. 36–37." There is reason to believe that Count Maurice of Nassau-Siegen made some of these paintings. On at least some of the figures of fishes there are notes in his handwriting. They are (in part) the originals of the figures in Marcgrave's great work.

— Historiæ rerum naturalium Brasiliæ libri VIII., a Joh. de Laet in ordinem digesti et annotationibus illustrati. Lugduni Batavorum et Amstelodami, 1648. figs. fol. Pre-Linn. 1648.1

This work, written in Brazil in cipher, was translated and edited by Jan de Laet. It forms section two of the "Historia Naturalis Brasiliæ," Leyden and Amsterdam, 1648, fol.

The first section of this volume is composed of William Piso's "De Medicina Brasiliensi," comprising four books.

The second section, by Marcgrave, comprises 303 folio pages, consisting of eight books and an appendix, and is illustrated by 429 figures. Book iv treats of fishes and crustaceans, both freshwater and marine, 105 of the former being described and 86 figured. Most of the figures were drawn by the author himself, as stated at the foot of the table of contents.

For elaborate commentaries on this work, see Lichtenstein, H., 1818.1, and Gudger, E. W., in the paper cited above.

— G. Marcgravii Historiæ rerum naturalium Brasiliæ (In Piso, G. "De Indiæ utriusque re naturali et medica libri quatuordecim." Amsterdam, 1658. fol.) Pre-Linn. 1658.1

Feeling aggrieved over De Laet's editing of the "Historia Naturalis Brasiliæ," Piso ten years later rewrote the whole book under the above title and completely appropriated all Marcgrave's work and material. For all the data bearing on this matter, see Gudger's sketch of Marcgrave, above.

Marcucius, Casp. Dissertatio de jejuniis et esu piscium in vere, adversus Leonh. Fuchsum. Venetiis, 1624. 12°. Pre-Linn. 1624.1

Title from Boehmer. Not found elsewhere.

Marées, Pieter de. Beschryvinge ende historische verhael van 't gout koninckrijk van Guinea, anders de Gout-custe de Mina genaemt, . . . etc. Amsterdam, 1602. viii, 129 p. obl. 4°. Pre-Linn. 1602.1

The 1st ed. Other Dutch eds.: Amsterdam, 1617 & 1650.

It also appeared in De Bry, "India Orientalis," Pt. vi; German, 1603, as "Warhaftige . . . Beschreibung dess gewaltigen goltreichen Königsreich Guinea." Also in "Purchas his Pilgrims," first in Latin and later in English.

— Description et récit historical du riche royaume d'or de Gunea, etc. Amsterdam, 1605. fol. Pre-Linn. 1605.1

Fishing by day and by night, pl. 9 (double). Chap. xxix deals with fishing and the fishes taken. Fishes, chap. xxxiii, p. 63-64.

— Beschryvinge van de goudt-kust Guinea; alsmede een voyage naer deselve. Waerin den aert des landts Koopmanschap, gedierten, vogelen, vischen . . . en visscherije der Swarten . . . seer duydelijk beschreven worden. Amsterdam, 1650. 5 pls. 4°. Pre-Linn. 1650.1

Fishes, p. 89-92. Fishing by day and by night, 2 pls. and description. Copies 1605 & 1650 eds., N. Y. P.

Mareschalcus, Nicol [1460-1525] Thuri historia aquatiliū. Rostoch, 1517. fol. Pre-Linn. 1517.1

This work, written in both Latin and Greek, describes the fishes of Thuringia.

A later and better known edition is:

— Historiæ aquatiliū lib. i. et ii, latine et græce. Rostochii, in ædib. Thuriis, 1520. figs. fol. Pre-Linn. 1520.1

An exceedingly rare work, mentioned by J. V. Carus in his "Geschichte der Zoologie," p. 269, and by Beckmann in his "Geschichte der Erfindungen," Bd. III, p. 431.

Margarita Philosophica. See Reisch, Gregory (editor).

Marggrave; Margrave, or Markgraf, George. See Marcgrave, George.

Markham, Gervase [c. 1568-1637] The young sportsman's instructor in angling, fowling, hawking, hunting, etc. [c. 1597] Pre-Linn. 1597.1

Another (dated) ed.: London, 1652. Republished, London, 1820; & in "The angler's garland and fisher's delight," 1871.

— The second book of the English husbandman . . . containyng a discourse of the general art of fishing with the angle, etc. London, 1614. xiv, 205 p. 4°. Pre-Linn. 1614.1

The first half of the "English husbandman," published 1613 and again 1614 & 1635, contains nothing on fishing. Other eds. "Second book": 1615 & 1635.

— The pleasures of princes, or good mens recreations. Contayning a discourse of the generall art of fishing, with the angle, or otherwise, and of all the hidden secrets belonging thereunto; . . . London, 1614. 54 p. sm. 4°. Pre-Linn. 1614.2

This forms the second part of the second book of his "English husbandman." The "art of fishing" was also used by Markham in his "Country contentments"; it contains many extracts rendered into prose, from the "Secrets of angling" by John Dennys. It was subsequently reprinted in 1615 and in 1635. It in turn was followed by:

— Cheap and good husbandry . . . together with . . . the making of fish ponds, and the taking of all sorts of fish. London, 1616. xx, 182 p. 4°. Pre-Linn. 1616.1

"Of fishing," chaps. i & ii. Other eds. followed, at least 16 appearing before 1683.

The "Way to get wealth." London, 1638, and many later editions apparently do not have anything on fishing. This appears, however, in:

— Countrey contentments; or the husbandman's recreations . . . The whole art of angling, etc. London, 1631. x, 117 p. 4°. Pre-Linn. 1631.1

4th ed. Earlier eds. (1611, 1613, 1615) do not contain "The whole art of angling," which is found in this and the 7 eds., 1635-1657.

An outgrowth of the above works is:

— A compleat and experienced angler . . . or the angler's vade mecum, etc. London, [c. 1712]. iv, 138 p. 24°. Pre-Linn. 1712.1

This was followed by a number of other works, and by editions of the various preceding books, all of which seem to contain chapters on angling and on the care of fish.

For lists of Markham's books with notes on their contents, see Lowndes, and Westwood & Satchell. For a commentary on "The art of angling," etc. 1614, see Marston, R. B. 1894.1.

Markham was the pioneer English hack writer. He borrowed right and left, wrote with ease, and printed his books in many confused editions. His first purloining was a reprint of the "Book of St. Albans" in 1595 under the title "The gentleman's academie, or the boke of St. Albans, etc. reduced to better form by G. M." He is one of the "old farmers" discussed by Donald G. Mitchell in his "Wet days at Edgewood" (1865.1).

Marshe, Thomas. A briefe collection and compendious extract out of the cosmography of Seb. Munster; wherein is made . . . a true report of the nature and properties of certaine fowles, fishes, monsters, etc. London, 1574. 8°. Pre-Linn. 1574.1

Marsigli, or Marsili, or Marsilli, Luigi Ferdinando (*Comte de*) [c. 1656–1730] Elogy in *Bibl. Franç.*, 17, 2. pt., no. 3. — Leipzig. *Gel. Zeit.*, 1733, 907. Life by Angelo Fabroni in *Archiv Neusten Geschichte*. 1. Th., 5. See also Quincy, L. D. C. H. D. "Mémoires sur la vie de M. le Comte de Marsigli." 4 vols. Zurich, 1741. sm. 8°; and Fantuzzi's biography, Bologna, 1770.

— Brieve ristrétto del saggio fisico intorno alla storia del mare. Venice, 1711. 72 p. figs. gr. 4°.

Pre-Linn. 1711.1

— Lettera scritta al Sig. Ant. Vallisnieri intorno all' origine della anguilla. *Giorn. Letter. Ital.*, 1717, 29, 206.

Pre-Linn. 1717.1

Republished in *Acta Vratisl.* 5, p. 1690. A French version of the first title is:

— Histoire physique de la mer. Ouvrage enrichi de figures dessinées d'après le naturel. Amsterdam, 1725. fol. 173 p. 41 pls. Pre-Linn. 1725.1

Translated into Dutch as "Natuurkundige Beschryving der Zeen," etc. The Hague, 1786. xxv, 216 p. 50 pls. fol.

— Danubius Pannonico-Mysicus, observationibus historicis, physicis per-lustratus et in sex tomos digestus. 6 vols. (in 3). Hagæ Comitum & Amstelodami, 1726. illust. fol.

Pre-Linn. 1726.1

Tom. IV. De piscibus in aquis Danubiis viventibus. Tom. VI. Observationes anatomicæ in Husone.

Reviewed in *Acta Erud. Lips.*, 1727; and in *Comm. Litt. Norimb.*, 1763. A French translation is listed below (1744).

— Lettera ad Antonio Vallisnieri il quale portatosi a bella posta sul Monte Bolca, ne dà una descrizione del luogo dove i pesci di mare si trovano, etc. (In Vallisnieri, A. De' corpi marini che sui monti si trovano. Venezia, 1728, 141–150.) Pre-Linn. 1728.1

— Lettera ad Antonio Vallisnieri di Luigi Ferdinando Marsilli . . . il quale portatosi a bella posta sul monte Bolca, ne dà non solamente una perfettissima descrizione, ma espone la fotografia del luogo dove i pesci di mare e molti crostacei si trovano . . . Con una notizia di A. Vallisnieri di un pesce di mare pieno d'uova trovato nel monte Bolca. (In *Opere fisico-mediche stampate e manoscritte del kavalier Antonio Vallisnieri raccolte da Antonio suo figlio*. Venezia, 1733, p. 359–363.)

Pre-Linn. 1733.1

— Description du Danube, depuis la montagne de Kalenberg jusqu'au confluent de la rivière Jautra, contenant des observations géographiques, hydrographiques, historiques et physiques. La Haye, 1744. 6 vols. fol.

Pre-Linn. 1744.1

Les poissons du Danube. Vol. IV, 33 pls.

Martens, Friedrich [1635–1699] *Spitzbergische oder Grönländische Reisebeschreibung, gethan im Jahre 1671*. Hamburg, 1675, 132 p. 16 pls. 4°.

Pre-Linn. 1675.1

Various versions follow.

— Viaggio: di Spizberga o Gronlanda fatto da Federico Martens Am-burghese l'anno 1671 . . . con una copiosa relazione di quell' agghiacciato clima, e de gli uccelli, quadrupedi, pesci, e piante rare, che vi nascono, colla descrizione delle Balene, e lor pesca . . . Bologna, 1680. 264 p. ill. 12°.

Pre-Linn. 1680.1

— Voyage into Spitzbergen and Greenland. (In "An account of several late voyages to the south and north. London, 1694) 207 p. pls.

Pre-Linn. 1694.1

Fishes, chap. vi, p. 120–129.

Full English version; an abbreviated is:

— [A voyage to Spitzbergen, in the ship call'd the "Jonas in the Whale," Peter Peterson of Frieseland, Master, in 1671.] (In Harris's Coll. Voy. and Trav. 1705, vol. I, 617–633.)

Pre-Linn. 1705.1

Of the finned fishes, p. 628.

There are Dutch translations at Amsterdam, 1685, and 1710, and there are various abridgments in various collections of voyages from 1694 to 1768. The work is best available to the present day English reader in White's edition in Hakluyt Soc., Works, no. 18. 1855.

Martin, Martin [—1719] A description of the western islands of Scotland, containing a full account of their situation, extent, soils, product, harbours, bays, tides, anchoring places and fisheries. London, 1716. 8°.

Pre-Linn. 1716.1

The 2nd and augmented ed., the 1st having been issued in 1703. At Glasgow in 1884, a page for page reprint of the 2nd ed. was issued.

This work abounds in references to fish and fishing, which may readily be located by means of its detailed table of contents.

Martyn, Benjamin [1699 1763] *Grammatica philosophica, conspectus statûs præsentis physiologiæ naturalis sistens, quatuor partibus. Pars iv. de globo terraqueo, etc; etiam partes cor-*

porum animalium et naturam bestiarum, piscium, insectorum, reptilium per dialogos exposita. London, 1735. fig. 8°. Pre-Linn. 1735.1

Martyr, Peter (*d'Anghera*) [1457–1526] For a sketch of his life and work and a bibliography of his publications, together with a list of books relating to his writings, see Schumacher, Hermann A. "Petrus Martyr der Geschichtschreiber des Weltmeeres. Eine Studie" [with copious notes] New York, 1879. 152 p. Also McNutt, F. A., translator and editor, cited in footnote below.

— Libretto di tutta la navigazione del re di Spagna de le isole et terreni novamente trovati. Venezia, 1504. Pre-Linn. 1504.1

Contains the first printed account of fishing with the remora or guiacanum.

Copy, J. C. B. Reproduced in facsimile in Thacher, John Boyd. "Christopher Columbus," etc. N. Y., 1903, vol. II, chap. xv; and in Wiener, cited below.

— [Fishing with the remora] (In Fracanzio, Montalboddo. Paesi novamente ritrovati et Novo Mondo, da Alberico Vesputio Florentiae intitolato. Vicenza, 1507. 120 leaves) Pre-Linn. 1507.1

Second printed account.

A number of editions and versions of this work are known. Copies, 1508 (4 eds.), 1516, 1517, 1519, 1521, J. C. B.

"Fishing with the remora" also found in:

— Legatio Babylonica, oceani decas [decade I], etc. Hispali (Seville), 1511. Pre-Linn. 1511.1

— De rebus oceanis et orbe novo decades tres, etc. Alcala, 1516. Pre-Linn. 1516.1

This latter work, consisting of the three decades with or without the addition of the fourth and other decades, passed through a number of editions. Harris notes Italian and German editions of 1520. Others are known from Basel, 1521, & Cologne, 1522. Still others are 1530 (2 eds.), 1532, 1533, 1536, 1564 (Italian), 1574, 1577 (French), & 1582 (German). In 1534, at Venice, appeared a compilation an integral part of which was a summary of Peter Martyr's writings on the New World. This is reprinted in the 3rd vol. of Ramusio's "Delle Navigationi et Viaggi." (q. v.). The issue of Peter Martyr printed 1530 seems to have been a complete edition, and an edition of eight Decades is accorded to Paris, 1536, by some bibliographers, but apparently the first edition bearing the words "Decades octo" on the title page is:

— De orbe novo Petri Martyris Anglerii mediolanensis, protonotarii et Caroli Quinti senatoris, decades octo, diligente temporum observatione et utilissimis annotationibus illustratae,

suoque nitore restituae labore et industria Richardi Hakluyti Oxoniensis, Arngli. Paris, 1587. Pre-Linn. 1587.1

This edition is dedicated to Sir Walter Raleigh: "illustri et magnanimo viro Gualtero Ralegho."

Later eds. are: Latin, Rotterdam, 1616, and its French translation, "Extrait ou recueil des îles nouvellement, etc." Another Latin version is "Opus epistolarum Petri Martyris," etc. Amsterdam, 1670. English versions follow:

— Decades of the Newe Worlde, or West India; conteyning the navigations and conquests of the Spaniards . . . etc. Written in the Latine tongue by Peter Martyr of Angleria; and translated into Englyshe by Rycharde Eden, with Oviedo's Indies . . . etc. London, 1555. Pre-Linn. 1555.1

Republished in Edwin Arber's book, "The first three English books on America." Birmingham, 1885.

A 2nd English ed. was published at London in 1577 under the title of "Rycharde Eden's History of Travayle in the West and East Indies [etc.] Augmented and finished by R. Willes."

In the 2nd ed., p. 211–215, is found the chapter on "Fishes, and of the manner of fishing," extracted from Oviedo.

A 3rd English ed. is Lok's extension of Eden, dated 1612. This was reprinted at London without date (c. 1625).

A present day admirable English version is:

De Orbe Novo: the eight decades of Peter Martyr d'Anghera translated from the Latin with notes and introduction by Francis Augustus MacNutt. 2 vols. N. Y., 1912. viii, 414 p. (I); 448 p. (II.) 8°.

Fishing with the remora, vol. I, p. 97; vol. II, p. 299–300. Fish rendered poisonous by eating manchineel, vol. II, 372. Methods of fishing on coast of Venezuela, vol. II, 378.

A modern Spanish edition was issued at Madrid, 1892, edited by Asensio. The authoritative French version is that edited by Paul Gaffarel, Paris, 1907.

The author of the "De Orbe Novo" was one of the foremost writers of his day on the natural and political history of the new world. His book, either in its parts or as a whole, passed through many editions, issues, and translations, and the preparation of his bibliography, even so far as it relates to fishes only, is a matter of great difficulty.

The great work of Peter Martyr in the domain of natural history was to make known to Europe the fauna and flora discovered by the Spaniards in the new world.

For critical notes on the origin of the word Guiacanum, and on the "fishing with the remora" story, see Wiener, L. "Africa and the Discovery of America." Philadelphia, 1920, vol. I, p. 61–67.

M[ascall] L[eonard] [. . . –1589] A booke of fishing with hooke and line, and of all other instruments thereunto belonging, etc. Made by L[eonard] M[ascall] London, 1590. 93 p. 4°. Pre-Linn. 1590.1

"The first part, containing the "Treatise of fishing" (clumsily taken and marred in the transfer from the "Book of St. Albans" ends at

Mascall, L.

p. 50 in the edition of 1590; the second part at p. 93." — W. & S.

Other eds. are: 1596, 1600, 1606.

Mascall was the pioneer fish culturist of England. For an analysis of his book and his plans for raising fish, see Marston, R. B. 1894.1. A modern reprint of the 1st edition with critical notes with reference to Mascall's sources, was issued under the editorship of T. Satchell in 1884. See Mascall, L. 1884.1.

Massarius, Francisco. Plinii libri II. de piscibus cum scholiis Joh. Cæsarii. a Franc. Massario, Veneto, explanati, quibus acc. Oppiani Halieuticon. Argentinae, 1534. 4°. Pre-Linn. 1534.1

— In nonum Plinii de naturali historia librum castigationes & annotationes. Quisquis de natura aquatili-um ac remotiore piscium cognitione edoceri cupis, hunc Massarii commentarium eme & lege. Basilæ, 1537. 32, 367 p. 8°. Pre-Linn. 1737.1

Not seen; title from Bosgoed. Cuvier states that another ed., published at Paris (1542), contains both the ninth and thirty-second books of the Natural History, with commentaries by Massarius.

Massey, William [1691–1764] Observations upon the remora or sucking fish. Gentleman's Mag. & Hist. Chron. [Urban's], 1753, 23, 162. — Dresden Mag., 1753, 1, 7. St., no. 4.

Pre-Linn. 1753.1

A review of the old literature.

Matthæus, — (respond.) Dissertatio de anguillis. Medic. Siles. Satyra, Argentorati [Strasburg], 1673, 20. 4°.

Pre-Linn. 1673.1

Georg Frank von Frankenau, præses.

Not seen; title from Walbaum. Agassiz gives date, 1675. Walbaum & Boehmer say Heidelberg, 1675.

Mattheus, Ant. (respond.) Dissertatio de harengis, vulgo halecibus dictis. Groningiae, 1649. 8°. Pre-Linn. 1649.1

Martin Schoock, præses.

Matthioli, Pietro Andrea [1500–1577] For biographical and bibliographical data, see Fabiani, Guiseppe. "La vita di Pietro Andrea Mattioli raccolta delle sue opere." Siena, 1872. x, 83 p. 8°.

— Il Dioscoride dell' eccellente Dottor P. A. Matthioli cò i suoi discorsi, con l'aggiunta dell' sesto libro dei remedi di tutti i veleni de lui nuovamente tradotto & con dottissimi discorci per tutto commentato. Vinegia [Venice], 1548. Pre-Linn. 1548.1

Fishes and other animals, in book II.

This is the very rare 1st ed. It is sometimes dated 1544, that being the date of the "Privile-

gio." Other Italian eds. are: Mantua, 1549; Venice, 10 eds., 1544–1744.

— Commentarii secondo aucti in libros sex Pedaci Dioscoridis de medica materia. Venetiis, 1552. fol.

Pre-Linn. 1552.1

First known reference to fossil fishes of Monte Bolca, in introduction to book v.

4th Latin ed. Other eds. in Latin: Venice (10), 1558–1598; Basel, 1574 & 1598. Of these, the authoritative version (Artedi editor), is:

— Commentarii in libros VI Pedacii Dioscoridis de medica materia, etc. Venetiis, 1565. clxx, 1459 p. ill. fol.

Pre-Linn. 1565.1

Contains many figures of fishes copied from Rondelet and Salviani.

Foreign language versions; Lyons, 1572, 1578, 1620 (French); Salamanca, 1566 (Spanish). There are a number of German versions entitled "Kreuterbuch," etc., but as these seem to comprise only the botanical sections of Matthioli's commentaries, they are not included here.

— Opera quæ extant, omnia. Francofurti, 1598. fol.

Pre-Linn. 1598.1

Another ed., Basel, 1674. fol.

— Degl' ittioliti del Bolca. Venezia, M. Gimani, 1621. Pre-Linn. 1621.1

Brocchi, in his "Conchiologia Fossile Subapennina," cites an edition of this work published in 1552.

Matthioli was a physician who practised at Rome, Trente, Carice, and Prague. His writings have to do with fishes mainly as articles of diet and for use in medicine. They have passed through many editions and translations.

Maurer, Felix. Von mancherlei Fischen und was sie im Wasser essen, auch ob sie Athem holen, sehen, hören, schreien. Observat. Curiosis. Phys., Frankfurt, 1713, 457–482.

Pre-Linn. 1713.1

Not seen. Title from Boehmer.

Maurice, Count of Nassau-Siegen. See **Nassau-Siegen, Johann Maurice** (Count of).

Maximilian II. See **Mercuriale, Girolamo.**

Medices, Sebastianus. Tractatus de venatione, piscatione et aucupio (In his Opera. Venice, 1586. fol.)

Pre-Linn. 1586.1

— The same. Separatim. Colonia [Cologne], 1588. 8°.

Pre-Linn. 1588.1

Other separates: Helmstadt, 1592; Cologne, 1598; Marburg, 1698. Finally as:

— The same (In Fritsch, A. Corpus juris venatorio-forestalis. Leipsic, 1702.)

Pre-Linn. 1702.1

Copy, 1598 issue, N. Y. P.

Meichelbeck, — [—c.1500]
Geschichte des Alpenkloster Benedikt-
beuren im Walchensee (In Chronicon
Benedictoburgæ. 1753. vol. I, p. 24.)
Pre-Linn. 1753.1

According to J. Wimmer, in his "Geschichte
des deutschen Bodens," p. 391-392, some ac-
count is given of Bavarian fishes.

Meier, Joachim [c. 1661-1732] Dis-
sertationes epistolice de claris Fischerei,
necnon de piscinis et piscatoribus, me-
morabilia quædam. Gottingæ. 1695.
4°. 5 pls. Pre-Linn. 1695.1

Menander, Carl Frederick (præses).
Dissertatio de regia piscatura Cu-
moensi. Inaug. Dissert. Aboæ, 1751.
48 p. 2 pls. 4°. Pre-Linn. 1751.1

Fred. Reinhold Brander, *respond.*

— Ichthyotheologiæ primæ lineæ.
Inaug. Dissert. Aboæ, 1751. 37 p. 4°. Pre-Linn. 1751.2

Nicolas Malm, *respond.*

Mengenbergh, Conrad von. See **Konrad von Megenberg.**

Mentzel, Christian [1622-1701]
Theatri rerum naturalium Brasiliæ,
tomus I continens icones aquatiliū.
1660. Pre-Linn. 1660.1

Labelled also "Libri Picturati A. 32-33-34-35." These oil paintings of the natural objects of Brazil, are preserved in the great library of Berlin. They were painted by George Marcgrave, Franz Post and other Dutch artists in Brazil, 1638-44, under Count Maurice of Nassau-Siegen. They were collected and arranged in order, by Dr. Mentzel (court physician to the Elector of Brandenburg, c. 1660), who wrote a preface to them and had them bound up in huge volumes with an illuminated frontispiece—probably of his own designing. Vol. I contains the fishes, 357 in number. Some of these paintings have notes in the handwriting of Count Maurice. For further data on their history, see Gudger, E. W. "George Marcgrave, etc." (Add. 1912.1). See also Post, Franz, this section.

— De stagno admirando Borussiæ
alternis triennis sponte piscoso et frugif-
ero. Misc. Acad. Nat. Cur., 1686,
dec. 2, 4. Pre-Linn. 1686.1

Mercklein, Georg Abraham [1644-1702] Neu aussgefertigtes historisch-
medicinalisches Thier-Buch, in vier
Theilen verabfasset; deren handelt . . .
III. Von Fischen und denen davon in
der Medicin brauchbaren Dingen, etc.
Nürnberg, 1696. xxiv, 732, 72 p. 96
pls. 8°. Pre-Linn. 1696.1

1st ed.; 2nd & 3rd, Nuremberg, 1714 & 1739.
These are probably close reprints of the first;
the third having the same number of pages.

Mercuriale, Hieronymus (Girolamo)
[1530-1606] De arte gymnastica libri

sex. In quibus exercitationum omnium
vetustarum genera, loca, morte facul-
tates, & quid quid de niq. ad corporis
humani exercitationes pertinet, dili-
genter explicatur. . . . Ad Maxi-
milianum II. Imperatorem. Venetiis,
1573. xii, 308, xxiv p. figs. 8°. Pre-Linn. 1573.1

Fishes, p. 181.

2nd ed. with many figs. added. Title from
Hecksher sale catalogue.

Merian, Maria Sibilla, afterwards
Graff. [1647-1717] Dissertatio de
generatione & metamorphosis in-
sectorum Surinamensium . . . item ap-
pendix transformationum piscium in
ranas & ranarum in pisces. Amster-
dam, 1719. fol. pls. Pre-Linn. 1719.1

The 1st ed. of the "Metamorphosis Insec-
torum Surinamensium" was issued Amstelo-
dami, 1705 in two texts, Latin & Dutch. The
1719 ed. also appears in Dutch. A third ed. in
Latin appeared in 1726, & a Dutch version of it
in 1730. Some copies have Latin and French in
parallel columns, others Latin & Dutch.

Interesting as the first known reference to the
fact that the tadpole is a stage in the transfor-
mation of fishes into frogs. See also Cappeler,
M. A. Add. 1767.1.

Merrett, Christopher [1614-1695]
Pinax rerum naturalium Britannicarum
continens vegetabilia, animalia et fos-
silia, in hac insula reperta inchoatus.
Londini, 1666. xxviii, 221 p. 8°. Pre-Linn. 1666.1

This contains some notes on fishes.

Other eds.: London, 1667 & 1704. 8°.

Meulen, S. van der [fl. 1700] Groote
visserij. Amsterdam, [c. 1700]. Pre-Linn. 1700.1

Contains 16 engravings by Adrian van der
Laan, from drawings by Van der Meulen and
others (all relating to the herring fishery).

Meurer, Noe. Wasser-Recht, für-
nehmlich des weitberühmbten und golt-
reichen Rheinstroms, . . . Item von
. . . Salmen. Cöllen [Colle], 1563. 4°. Pre-Linn. 1563.1

Fishes, p. 112-115.

— Jag und Forstrecht, . . . auch
den Wildtbanen, Fischereyen und was
solchen anhangt. Franckfurt, 1582.
189 leaves. fol. Pre-Linn. 1582.1

"189 folios, the first four of which are not
numbered. Printed by Peter Schmid, in 1581
and containing engravings by Jost Amman,
chiefly from the "Jag und Weydwerck Buch,"
also published by Feyerabends, to which this
volume closely corresponds in size, type, paper
and illustrations."—W. & S.

Another ed., Marburg, 1618. 270 p. fol.

— Tractatus juridicus de alluvione
insulis, alveo et jure aquatico oder vom
Wasser-Recht. Nürnberg, 1733. 8°. Pre-Linn. 1733.1

Meyer, Johann Daniel. Angenehmer und nützlicher Zeitvertreib mit Betrachtung curioser Vorstellungen allerhand kriechender, fliegender, und schwimmender aus dem Land und Wasser sich befindender und nährenden Thiere, so wohl nach ihrer Gestalt und äusserlichen Beschaffenheit, als auch nach der accuratest davon verfertigten Structur ihrer Scelette oder Bein-Körper, nebst einer physikalisch und anatomisch, besonder aber osteologisch und mechanischen Beschreibung der selben nach der Natur gezeichnet, gemahlet und in Kupfer gestochen. 3 vols. Nürnberg, 1748-56. 240 pls. fol. Pre-Linn. 1748.1

This work, by a painter of Nuremberg, consists of fine figures of fishes arranged without order. The accompanying text is very poor. Issued in parts: I, 1748. 100 copper plates; II, 1752. 100 pls.; III, 1756. 40 pls. Reviewed in *Comm. de Rebus*, 1748, 2, 83.

Moehring, Paul Heinrich Gerhard [1710 or 20-1792] *Rajæ clavatæ auctorum adfinis.* *Acta Acad. Leop. Carol. Nat. Cur.*, 1742, 6, 483-484. Pre-Linn. 1742.1

— *Raja varia, corpore medio glabro, cartilagine transverso in dorso et ventre, triplici aculeorum ordine in cauda.* *Acta Acad. Leop. Carol. Nat. Cur.*, 1742, 6, 485-486. Pre-Linn. 1742.2

— *Raja varia, dorso medio glabro, unico aculeorum ordine in cauda.* *Artedi, Ichthyol. gen.* 37. syn. 102. *Acta Acad. Leop. Carol. Nat. Cur.*, 1742, 6, 482-483. Pre-Linn. 1742.3

Moffett, or Moufet or Muffet, Thomas [1553-1604] *Insectorum sive minimorum animalium theatrum: olim ab E. Wottono, C. Gesnero, T. que Pennio inchoatum: tandem T. Moufeti . . . opera . . . concinnatum, auctum, perfectum; et ad vivum expressis iconibus . . . illustratum.* Londini, 1634. xx, 326 p. illust. fol. Pre-Linn. 1634.1

Contains 2 excellent figures of Hippocampus, the male having the brood pouch well developed. Copy, A. M. N. H.

— The same. English version. (In *Topsell, Edward.* *History of foure-footed beastes, etc.* London, 1658. p. 889-1130). Pre-Linn. 1658.1

Monro, Alexander (primus) [1697-1767] *An essay on comparative anatomy.* London, 1744. 138 p. 8°. Pre-Linn. 1744.1

Published anonymously by the first of three anatomists of this name, and believed to be one of the earliest formal treatises on the subject.

See also Severinus, M. A. in this section. Several times republished: first as, "The anatomy of the human bones, nerves . . . , to which is added his treatise of comparative anatomy," etc. 2 vols. Edinburgh, 1785; second, as "Traité de l'anatomie comparée, etc." Paris, 1786; also included in Walbaum, J. J. "Petri Artedi Renovati. Pars. II. Philosophia Ichthyologica." Grypeswaldiæ, 1789, 184-192; also in "The works of Alexander Monro, M. D. (primus), with the life of the author." Edinburgh, 1781. pls. 4°.

Translated into German, as "Sämmtliche Werke" with the "Vergleichenden Anatomie" annexed. Leipzig, 1782; and the latter published as a separate brochure at Göttingen, 1790. Finally the treatise on comparative anatomy was published at Edinburgh, 1791, as an appendix to "A system of anatomy and physiology with the comparative anatomy of animals," etc. compiled by A. Fife (chiefly from the works of A. Monro, primus) and revised by J. Rotherham.

See also Monro, A. (secundus), 1785.1.

Montanus, Arnoldus [-1687] *Gedenkwaerdige gesantschappen der Oost-Indische maatschappij in 't Vereen. Nederland, aan de Kaisaren van Japan, . . . beschryving van dieren, . . . etc.* Amsterdam, 1669. viii, 471 p. pls. fol. Pre-Linn. 1669.1

Japanese fishermen & fishing, p. 55 & 279. figs.

This was often republished and translated.

— *De nieuwe en onbekende Weereld; of beschryving van America en 't Zuid-land, etc.* Amsterdam, 1671. fol. Pre-Linn. 1671.1

This compilation contains data on fishes and fishing in the new world. Translated, it appeared as:

— *America, being the latest and most accurate account of the New World, etc.* London, 1671. Pre-Linn. 1671.2

J. Ogilby's version. See 1671.1.

Montalembert, René (Marquis de) [1714-1800] *Observation sur la fontaine de Gabard en Angoumois, dans laquelle on trouve des brochets aveugles et ceux qui sont borgnes, le sont tous de l'oeil droit.* *Mém. Acad. Sci. Paris*, 1748, hist., 27-28. Pre-Linn. 1748.1

Moor, Bartholomæus. *De piscium et avium creatione oratio habita pridie Idus Aprilis Harderovici MDCCXVI. Harderovici [Harderwijk], 1716. 68 p. 4°.* Pre-Linn. 1716.1

Not seen. Date according to Agassiz, Bosgoed, Carus & Engelmann. Boehmer, and Gronow say 1721.

Moore, (Sir) John. *England's interest, or the gentleman and farmer's*

friend, with the angler's sure guide. Instructions for ordering of fish ponds, and for the increasing of fish. London, 1703. 166 p. 12°. Pre-Linn. 1703.1

2nd ed. (1st undated); others: London, 1705, 1707, 1721. The last, augmented, is:

— The angler's guide. Instructions for the profitable ordering of fish ponds, and for the increase of fish, and a guide for young anglers, teaching them the best method of catching trout, carp, barbels, jacks, pikes, perch, roach, dace, etc. London, 1721. 12°. Pre-Linn. 1721.1

Mor de Nigro Monte, Georgius. Tractatus novus, elegans, omnium pulcherrimus et doctissimus de jure venandi, aucupandi et piscandi. Spiræ, 1602. vi, 144, xvi p. 4°. Pre-Linn. 1602.1

Other eds.: Spiræ, 1605, 1612, 1692. Also found in Fritsch, A. Pre-Linn. 1702.1.

Morand, Sauveur [1697–1773] Observation sur une carpe dans la quelle on voyoit distinctement d'un côté les oeufs et de l'autre la laite. Mém. Acad. Sci. Paris, 1737 (1740), hist., 51–52. Pre-Linn. 1740.1

Morhard, Joan. Tractatus de miraculis . . . Argentinae, 1631. 4°. Pre-Linn. 1631.1

Liber III. De piscibus, p. 202; de piscibus ingentis magnitudinis, p. 205; de piscibus magnis, p. 208; de piscibus in aquis dulcibus, p. 216.

Moriggia, Paolo. Historia della nobiltà et degne qualità del Lago Maggiore, nella quale si descrive dove nasce il fiume Tecino e sua uscita; con la lunghezza e larghezza del Lago, e tutte le sorti di pesci ch' egli produce. Milano, 1603. 8°. Pre-Linn. 1603.1

Moritz, Count of Nassau-Siegen, see **Nassau-Siegen, Johann Maurice** (Count of).

Moro, Anton Lazzaro [1687–1764] De' crostacei e degli altri marini corpi che si truovano su' monti. Libri due. Venezia, 1740. 8 pls. Pre-Linn. 1740.1

"Parla dei pesci marini che si truovano sul Bolca monte del Veronese e spiegasi come sienovi andati." Dal Nero.

Mortimer, Cromwell [—1752] An account of Mr. Mark Catesby's essay towards the natural history of Carolina and the Bahama Islands, with some extracts out of the sixth and seventh setsfishes II. Phil. Trans. Roy. Soc.

London, 1734 (1735), 38, 315–318. *Ibid.*, 1735 (1738), 39, 112–114.

Pre-Linn. 1735.1

— Index piscium in Ichthyographia Willughbyana vel descriptorum vel depictorum, eorum nominum Anglicanorum, Belgicorum, Germanicorum, Gallicorum, Italicorum, Lusitanicorum, etc. Additis synonymis per varias Magnae Britanniae provincias usitatis, etc. (In Willughby, F. De historia piscium libri quatuor, etc. Londini, 1743.) 1740, 12 p. fol. Pre-Linn. 1740.1

The printers' subscription at the end of this paper bears date, 1740. The Dictionary of National Biography expressly states that Mortimer prepared this index especially for the 1743 edition of Willughby. Evidently there was some delay in issuing the whole volume, hence the discrepancy in dates.

— [An account of the horn of a swordfish struck several inches into the side of a ship]. Phil. Trans. Roy. Soc., 1741 (1744), 41, pt. 2, 862–864. Pre-Linn. 1744.1

— The description of a fish named *Opah guiniensium* (= *Lampris guttata*), shewed to the Royal Society by Mr. Ralph Bigland. Phil. Trans. Roy. Soc. 1750, 46, 518–520. figs. Pre-Linn. 1750.1

Mortimer, J. [c. 1656–1736] The whole art of husbandry, or, the way of managing and improving of land, etc. By J. M. Esq., London, 1707. 8°. Pre-Linn. 1707.1

Book vi. chap. 21. "Of fish-ponds, how to store, manage and order them for each sort of fish, etc."

Other eds.: London, 1712, 1716, 1721; 1753 (German); 1765 (French).

Morton, John [c. 1671–1726] The natural history of Northamptonshire; etc. London, 1712. 597 p. 14 pls. fol. Pre-Linn. 1712.1

Fishes, p. 418–423.

Morton, Thomas [c. 1590–1646] New English Canaan; or New Canaan, containing an abstract of New England. Composed in three bookes. . . . II. The natural indowments of the countrie, & what staple commodities it yeeldeth, etc. 1632. Pre-Linn. 1632.1

"Of the fishes, and what commodity they prove."

Reprinted in Force's Historical Tracts, 2, tract 5. Extracts in Rept. U. S. Fish Comm. 1871–72 (1873), 157–159.

Moscardo, Ludovici. Note overo memorie del Museo del Conte Lodovico Moscardo, etc. Padua, 1656. Pre-Linn. 1656.1

1st ed. Monte Bolca fishes, p. 182.

Moscardo, L.

— The same, 2nd ed. 2 vols. [in 1] Verona, 1672. figs. fol.

Pre-Linn. 1672.1

Vol. I, fossil fishes, p. 182, figs.; recent fishes, 224–231, figs.

Moufet, Thomas. See **Moffett, Thomas.**

Müller, W. J. Die Africanische auf der Guineischen Goldcüst gelegene Landschaft Fetu. Nürnberg, 1675. pls. 8°.

Pre-Linn. 1675.1

Fisheries, 219–240.

Münster, Sebastian [1489–1552] Cosmographia, Beschreibung aller Länder, etc. Basel, 1543 [or –44]. fol.

Pre-Linn. 1543.1

First issue of a popular work which passed through many eds. Some are: Basel, 1545, 1550 & 1552; and (Germ.) Basel, 1578 & 1621: — all sm. fol. The most prized ed. is the 1550. Copies, 1552 ed. Col. & N. Y. P. Seen by us is:

— Cosmographiæ universelle lib. VI. Basilæ, 1552. Pre-Linn. 1552.1

Contains some data on fish and fishing.

Muffet, Thomas. See **Moffett, Thomas.**

Muralt, Johannes von [1645–1737] Examen anatomicum *Mustelæ fluvialis*. Ephemer. Acad. Nat. Cur., 1682 (1683), ann. 1, 124–128. — Amphitheatrum Zootomicum. (Valentini, M. B.), 1720, pt. 2, 132–133. Pre-Linn. 1683.1

— Examen anatomicum trutta magnæ. Misc. Acad. Nat. Cur., 1682 (1683), dec. 2, ann. 1, 128–129. — Amphitheatrum Zootomicum. (Valentini, M. B.), 1720, pt. 2, 121–122.

Pre-Linn. 1683.2

— Exercitationes medicæ, observationibus et experimentis mixtæ. Amstelodami, 1688. 12°.

Pre-Linn. 1688.1

Anatomy of *Mustela* and *Anguilla*.

— Zoologia seu animalium contemplatio physica, philosophiæ et medicinæ studiosos pernecessaria. Tiguri [Zurich], 1709. 382 p. 8°.

Pre-Linn. 1709.1

Contains data on Swiss fishes.

— Zoologiæ continuatio de avibus, piscibus, serpentibus et insectis. Tiguri, 1709–10. 8°. Pre-Linn. 1709.2

Musgrave, William [c. 1655–1721] An account of some experiments relating to digestion and of a large bed of glands observed in the stomach of a jack [fish]. Phil. Trans. Roy. Soc., 1684, 14, 699–701. 2 figs.

Pre-Linn. 1684.1

Musurus, Marcus (Archbishop of *Malvasia*) (editor) [1470–1517] Oppianou 'Alieutikon biblia pente. Oppiani de natura seu venatione piscium libri quinque [Edited by M. Musurus]. Florentiæ, 1515. 8°. Pre-Linn. 1515.1

See also Oppian, Pre-Linn. 1515.1.

Mylius, Gottlieb Friedrich [1675–1726] Memorabilium Saxoniae subterraneæ i. e. Des Unterirdischen Sachsens seltsamer Wunder der Natur, etc. 2 vols. Leipzig, 1709–1718. 80 & 89 p. 44 pls. 4°.

Pre-Linn. 1709.1

In vol. I, certain fossil fishes are figured and described.

2nd ed., Leipsic, 1720.

N

N. Voyages au côtes de Guinée & en Amérique. Amsterdam, 1719. 416 p. illust. Pre-Linn. 1719.1

Marine fishes of Guinea, p. 69-70. pl. Fight between swordfish and whale, p. 69. Fishes of St. Thomas, p. 152-160. 3 pls. Manta, p. 157-160. fig.

Copy, A. M. N. H.

Nassau-Siegen, Johann Maurice (Count of) Governor-general of Dutch Brazil, 1637-1644. Friend and patron of Marcgrave and Piso in their work on the natural history of Brazil, and possibly joint painter with Marcgrave of the plants and animals illustrated in the "Historia Naturalis Brasilia." See hereon, "George Marcgrave," etc., by E. W. Gudger, Add. 1912.1. Also Mentzel, Christian, & Post, Franz. (This section.)

Neck, Jacob Cornelisz van. Journal ofte dagh-register . . . dor de acht shepen van Amsterdamme, onder . . . Jacob Cornelisz Neck . . . ende Wybrandt van Warwick . . . in den jare 1598, etc. Amsterdam, 1600. 40 folios & append. obl. 4°. Pre-Linn. 1600.1

Fishing scene at isle of Mauritius, folio 6, pl. 2; at Gammelamme, folio 35, pl. 15.

— Het tweede boeck, journael ofte dagh-register, etc. Middelburch, 1601. 50 folios & append. obl. 4°.

Pre-Linn. 1601.1

Fishing scene at Mauritius, folio 7. City of Gammelamme with fishing scene, folio 40, pl. 15.

Other eds.: Amsterdam, 1601 & 1608. Versions in other languages are:

— Le second libre, journal ou comptoir; contenant le vray discours et narration historique, du voyage fait par les huit navires d'Amsterdam . . . sous la conduite . . . Nec & . . . Warwick. Amsterdam. 1601. fol.

Pre-Linn. 1601.2

Another ed., Amsterdam, 1609.

— A journal, or dayly register of the voyage accomplished by six [eight] ships of Amsterdam to the East Indies. London, 1601. 4°. Pre-Linn. 1601.3

— Historiale beschryvinge, inhoudende een waerachtig verhael . . . acht

schepen vom Amsterdam. Amsterdam, 1619. Pre-Linn. 1619.1

All the above in N. Y. P. For other versions (not seen by us and not known to contain the data cited above), consult P. A. Thiele. Add. 1867.1

Neckham, Alexander (Abbot of Cirencester) [1157-1217] De naturis rerum libri duo. [MS. c. 1180]

Pre-Linn. 1180.1

Edited by Thos. Wright and published under the direction of the master of the rolls in "Chronicle & Memorials of Great Britain & Ireland in the Middle Ages." London, 1863, 34, lxxviii, 521 p. See Wright, Thomas. 1863.1.

Book II, chaps. 22-46, treat of fishes; chap. 47, of the construction of a fishing net.

Needham, John Turberville [1713-1781] An account of some new microscopical discoveries . . . Likewise observations on the supposed embryo of the sole-fish fixed to the bodies of shrimps, etc. London, 1745. vii, 126 p. 6 pls. 8°. Pre-Linn. 1745.1

"On the supposed embryo of the sole-fish fixed to the body of shrimps," pt. iv. Egg of the ray, chap. 10.

First issued under initials N., T. Second issue (also 1745) bore author's name.

— Nouvelles découvertes faites par le microscope, etc. Leide, 1747. 8 pls. 8°. Pre-Linn. 1747.1

The egg of the ray, p. 108.

Another French ed., Paris, 1750.

Needham, Walther [c. 1631-1691] Disquisitio de formato foetu. London, 1667. 12°. Pre-Linn. 1667.1

Republished, Amsterdam, 1668.

Respiration of fishes considered.

— Descriptio anatomica Cyprini. (In Valentini, M. B. Amphitheatrum zootomicum Francofurti, 1720, pt. 2, 123-124. pl. 73.) Pre-Linn. 1720.1

— Descriptio anatomica Lucii et Alosæ (In Valentini, M. B. Amphitheatrum Zootomicum, Francofurti, 1720, pt. 2, 122-123. pl.)

Pre-Linn. 1720.2

— De biolychnio & ingressu aeris in sanguinem.

Not seen by us. Our only reference from M. B. Valentini's "Amphitheatrum zoötomicum," 1720. (q. v.)

Nelson, William (Barrister) [*fl.* 1720] The laws of England concerning game. Of hunting, hawking, fishing, and fowling, etc. London, 1727. xx, 300 p. 18°. Pre-Linn. 1727.1

Other eds.: 1732, 1736, 1751, 1753, 1762.

Neucrantz, Paul [1605–1671] De harengo, exercitatio medica in qua principis piscium, exquisitissima bonitas, summaque gloria, asserta et vindicata. Lubecæ, 1654. 88 p. 4°. Pre-Linn. 1654.1

Nieremberg, Juan Eusebio [1595–1658] Historia naturæ, maxime peregrinæ, libris xvi. distincta. In quibus rarissima naturæ arcana, . . . & ignota Indiarum animalia, quadrupedes, aves, pisces, reptilia, insecta, zoophyta, plantæ, metalla, lapides, & alia mineralia, fluviorumque & elementorum conditiones, etiam cum proprietatibus medicinalibus describuntur; etc. Antverpiæ, 1635. 502 p. 50 leaves. figs. fol. Pre-Linn. 1635.1

Fishes, book xi.

Several editions in Spanish.

Copies, 3 eds., Arn.

— *Filosofia curiosa y tesoro de marviglias de la naturaleza*. 2 vols. Madrid, 1637. 8°. Pre-Linn. 1637.1

— *Curiosa y occulta filosofia de las maravillas de naturaleza, que contiene historias muy notables — secretos y problemas de la naturaleza*. Madrid, 1643. 8°. Pre-Linn. 1643.1

Another edition, apparently identical with the above, Barcelona, 1644. 8°.

Of this author, professor of physiology in the royal academy of Madrid, and of his book, Cloquet remarks: "Le jésuite Nieremberg, dans cet ouvrage qui n'est qu'une compilation sans goût et sans jugement, a montré de l'érudition, mais n'a avancé en rien l'histoire naturelle des poissons dont il a parlé, non plus que celle des autres objets dont il a traité dans son livre."

Nieuhof, Joan [*c.* 1610–1672] Het Gezantschap der Neerlandtsche Oost-Indische Compagnie aan den grooten Tartarischen Cham, den tegenwoordigen Keizer van China . . . 1655–1657, etc. Amsterdam, 1665. xii, 208, 258 p. 148 pls. ills. fol. Pre-Linn. 1665.1

Contains numerous notes on fishes.

Other eds.: Amsterdam, 1670, 1693. fol. Versions in various languages follow.

— *L'ambassade de la Compagnie orientale des Provinces Unies vers l'empereur de la Chine, etc.* Amsterdam, 1665. Pre-Linn. 1665.2

Another French ed., Amsterdam, 1682.

— *Die Gesandtschaft der Ost-Indischen Gesellschaft in den Vereinig-*

ten Niederländen an den Tartarischen Cham, etc. Amsterdam, 1666. iv, 444 p. 144 pls. fol. Pre-Linn. 1666.1

Other German eds.: Amsterdam, 1669, 1675; also found in Arkstee & Merkus, *Allg. Hist. Reisen*. 1749, vol. V.

— *Legatio Batavica ad magnum Tartariæ Chamum, etc.* Amsterdam, 1668. Pre-Linn. 1668.1

— *An embassy from the East India Company of the United Provinces to China, etc.* London, 1669. fol. Pre-Linn. 1669.1

— *Gedenkwaardige zee en lantreise door de voornaemste lanschappen van West en Oostindien*. 2 pts. (in 1) Amsterdam, 1682. xii, 240, lv, 308 p. fol. Pre-Linn. 1682.1

Descriptions & figures of 40 fishes, p. 268–281, part II.

Parts I & II were also separately issued under the following titles:

— *Gedenkweerdige Brasiliaense zee- en lant-reize . . . Benefens een bondige beschryvingh van gantsch Neerlants Brasil*. Amsterdam, 1682. pls. fol. Pre-Linn. 1682.2

— *Zee- en lant-reize, door verscheide gewesten van Oost-Indien . . . inzonderheit een wijtloopig verhael der stad Batavia*. Amsterdam, 1682. 42 pls. fol. Pre-Linn. 1682.3

Another ed., 1693.

Forty fishes figured & described, p. 268–281.

English translations of Nieuhof's voyages to Brazil and the East Indies are found in abridged form in Churchill's "Voyages," 1704, vol. II; Pinkerton's "Voyages," 1811, vol. VII, and 1813, vol. XIV.

His notes on East Indian fishes have been collected as:

— *Pisces Indiæ Orientales* (in) *Appendix ad historiam naturalem piscium* (In Willughby, F. *De historia piscium, etc.* Oxonii, 1686. fol. ills.) p. 1–7. Pre-Linn. 1686.1

Ninmero, Jacobus (*respond.*) *Disputatio juridica de jure venandi, aucupandi et piscandi*. Inaug. Dissert. Marpurgæ (Marburg), 1604. 3 pls. 4°. Pre-Linn. 1604.1

G. Antonius, *præses*.

Nobbes, Robert [1652 — *c.* 1706] *The complete troller, or, the art of trolling. With a description of all the utensils, instruments, tackling, and materials requisite thereto: with rules and directions how to use them, etc.* London, 1682. xx, 78 p. 8°. Pre-Linn. 1682.1

Other eds.: Norwich & London, no dates. Facsimile reprint, *c.* 1790. Later eds.: London, 1805 & 1814.

Noël, — Mémorial alphabétique des matières des eaux et forêts, pesches et chasses. Paris, 1737. 4°. Pre-Linn. 1737.1

Nollet, Jean Antoine [1700–1770] Mémoire sur l'ouïe des poissons et sur la transmission des sons dans l'eau. Mém. Acad. Sci. Paris, 1743 (1746), 199–224. pl. Pre-Linn. 1746.1

Nonnius, Ludovicus [c. 1553–] Ichthyophagia sive de piscium esu commentarius. Antwerp, 1616. 176 p. 8 pls. 8°. Pre-Linn. 1616.1

A learned work which reflects the attitude of the physicians of the time.

Copy, A. M. N. H.

— Diaeteticon, seu de re cibaria libri iv. Antwerpiae, 1627. 8°. Pre-Linn. 1627.1

Other eds.: Antwerpiae, 1633 & 1645.

North, Roger [1653–1734] A discourse of fish and fish-ponds. Done by a person of honour. London, 1713. 79 p. sm. 8°. Pre-Linn. 1713.1

Treats especially of culture of carp.

Osmund Lambert, in his "Angling literature in England," calls this "the principal English work of early date on fish-culture."

Other issues: London, 1714, 1715, & 1773. The last only has the author's name on the title-page. The "Discourse" was appended to his "The gentleman farmer," 1726; and to Albin's "Esculent fish," 1794. For this work and its 1835 reprint, see North, R., vol. II, p. 200. A French version is:

— Traité des étangs, des viviers, des canaux, etc. Paris, 1717. Pre-Linn. 1717.1

Nozeman, Cornelius [—1786] Beschrijving van den rivier-harder

[*Cyprinus dobula*]. Uitgez. Verh. 1757, 1, 576–580. Pre-Linn. 1757.1

— Beschryving van een onge-meenen inlandsen vis. [*Liparis barbatus*]. Uitgez. Verh., 1757, 1, 581–584. figs. Pre-Linn. 1757.2

— Beschrijving van een zeldzamen vis [*Argentina* sp.]. Uitgez. Verh., 1758, 3, 381–386. figs. Pre-Linn. 1758.1

Nuening, Jodocus Herman, & Cohausen, J. H. Commercii litterarii dissertationes epistolicae historico-physico-curiosae . . . de glossopetris, lapidibus cordiformibus, . . . cum utriusque historica bibliographia et praefatione epistrica S. E. E. Cohausen &c. 3 vols. Francofurti ad Mœnum, 1746–50. 8°. Pre-Linn. 1746.1

Nylant, P., & Hextor, J. van. Schouw-tooneel der aertsche schepselen; afbeelding allerhande menschen, beesten, vogelen, visschen enz. Amsterdam, 1672. 8 vols. 160 pls. 4°. Pre-Linn. 1672.1

Translated into German as:

— Schauplatz irdischer Geschöpfe worinnen allerhand Menschen, unvernünftige Thiere, Vögel, Fische, und dergleichen, sampt Beschreibung ihrer Gestalt, Beschaffenheiten, Natur, Vermögen, Eigenschafften und Neigungen vorgestellt werden . . . etc. Osna-brück, 1678. 160 figs. 4°. Pre-Linn. 1678.1

Part iv: Die Abbildung und Beschreibung allerlei Fische, p. 237–308.

O

O., D. C. *Acipenseris sive sturionis anatome.* Nouv. Lit. Germ. Hamburg, 1703, 325. Pre-Linn. 1703.1

— *Observatio de sexu salmonum.* Nouv. Lit. Germ. Hamburg, 1703, 364. Pre-Linn. 1703.2

Odoric of Pordenone (*Friar Beatus*) [c. 1286–1331] For brief sketches of Friar Odoric, see those by Henry Yule and C. R. Beazley in *Encyclopædia Britannica* (11th ed.), 1911, vol. XX; and by O. Hartig in the *Catholic Encyclopædia*, New York, 1911, vol. XII. Further biographies are referred to in these articles.

— *Odorichus de rebus incognitis.* Pesaro, 1513. Pre-Linn. 1513.1

First ed. Reprinted in vol. II of Ramusio's "*Naviatione e Viaggi*," ed. (2nd) of 1574, and in the ed. of 1583. An early English version, probably the first, is:

— *Journall of Frier Odoricus . . . concerning strange things which he sawe among the Tartars of the East.* (In Hakluyt, R. *The principal navigations, voyages, trafiques and discoveries of the English nation.* 1599, vol. II, p. 53–67.) Pre-Linn. 1599.1

This "Journal" passed through many editions and versions — too numerous to list here. The best eds. are those by Asquine, Udine, 1737; G. Yenni, Venice, 1761; H. Yule ("*Cathay and the way thither*"), London, 1866, (Hakluyt Soc., Works, no. 36); & H. Cordier, Paris, 1891. An excellent English version (apparently a reprint of Hakluyt's 1599 edition) is:

The journall of Frier Odoricus, etc. (In Ashton, J. (editor). *The voiage and travayle of Sir John Mandeville Knight.* London, 1887. 289 p. 12°.) p. 221–265.

Fishes which cast themselves ashore, chap. vi. Fishing with the cormorant — earliest known reference, chap. ix.

For the latest English version known to us, see *Odoricus of Pordenone* (Friar), 1915.1.

Ogilby, John [1600–1676] *America, being an accurate description of the new world, containing . . . their peculiar plants, beasts, birds and serpents.* London, 1671. 675 p. 41 pls. Pre-Linn. 1671.1

Contains descriptions of various kinds of fishes, copied from earlier writers.

This is a translation of Montanus, Arnoldus. "*De nieuwe en onbekende Wereld, etc.*" See Montanus, A., this section, 1671.1

Olafsen, Jon. *Ichthyo-Graphia Islandica, eller underretning om de fiske som leve salt og ferskt vand udi Island sammen skreven i Kjöbenhavn anno 1737.* 131 p. 4°. Pre-Linn. 1737.1

This valuable MS. to which reference is made by F. Faber in his "*Naturgeschichte der Fische Islands*," 1829, is in the library of the British Museum (Natural History).

Olaus Magnus. See **Magnus, Olaus.**

Oldmixon, John [1673–1742] *The British empire in America, etc.* 2 vols. London, 1708. 8°. Pre-Linn. 1708.1

Scattered notes on fishes throughout. Fishes of the Caribbean, vol. II, p. 176–180; 190–191.

Olearius, Adam [1600–1671] *Moscovitische und Persianische Reisebeschreibung.* Slesvic., 1647. fol. Pre-Linn. 1647.1

Other issues: Schleswig, 1656, 1663, 1671; Hamburg, 1669; Paris (French), 1656, 1659, 1679; Amsterdam, 1666, 1627, 1651 (Dutch); Utrecht, 1651 (Dutch). An English version is:

— *The voyages & travels of the ambassadors sent by Frederick, Duke of Holstein to the Great Duke of Muscovy, and the King of Persia. Begun in . . . 1633 and finish'd in 1639 . . . Whereto are added the travels of J. A. de Mandelslo . . . from Persia, into the East-Indies. Containing a . . . description of Indosthan, the Mogul's Empire, the oriental islands, Japan, China, &c . . . In III books . . .* London, 1662. xxiv, 424, iv, 287 p. 4 pls. 7 maps. 4°. Pre-Linn. 1662.1

Fishes and fishing in Volga river and Caspian sea.

2nd ed. (Olearus only), London, 1669. Copy, N. Y. P.

— *Gottorffische Kunst-Kammer, worinnen allerhand ungemeine Sachen, so theils die Natur, theils künstliche Hände hervorgebracht und bereitet, vor diesem aus allen vier Theilen der Welt zusammen getragen, und vor einigen Jahren beschrieben.* Schleswig, 1666. 88 p. 36 pls. obl. 4°. Pre-Linn. 1666.1

Second ed., Schleswig, 1674. Ten fishes are described.

Oppian [*fl.* c. 172–210 A.D.] For an evaluation of Oppian's services to natural history, see Schneider, J. G. Add. 1783.1. For a biographical notice, see Martin, T. H. "Etudes sur la vie et les oeuvres d'Oppian de Cilicie." Paris, 1863. 8°. For further notices of Oppian's life and works, see in modern editions listed below.

— De piscatu libri v. L. Lippius . . . traduxit. Colle, 1478. 64 leaves. 4°. Pre-Linn. 1478.1

The first edition of Oppian, and very rare.

— Halieutika de natura seu venatione piscium lib. v. (Graece, edente M. Musuro). Florentiae, 1515. 8°. Pre-Linn. 1515.1

The 1st ed. of the Greek text & very rare. See Musurus, M., this section.

— De piscibus, L. Lippio interprete, lib. v. [Text in Greek and Latin] Venetiis, 1517. 168 leaves. 8°. Pre-Linn. 1517.1

First edition in both languages. Very rare and valuable.

Three eds. of the above work were issued at Paris in 1555 by different publishers; one in Greek and two in Latin. One of the latter is a reprint of Lippius's 1478 translation. Other eds. are: Strasburg, 1534 & Paris, 1549. The former, a copy of which is in A. M. N. H., is entitled:

— Oppiani poetæ Halieuticon, sive de piscibus, libri quinque e graeco . . . Laurentio Lippio Collensi interprete, etc. Argentorati [Strasburg], 1534. Pre-Linn. 1534.1

A later ed. is entitled:

— De venatione libri iv. de piscatu libri v. Lugduni Batavorum, 1597. 8°. Pre-Linn. 1597.1

Contains both Greek and Latin texts with notes and emendations by Conrad Rittershusius, and a list of writers on fishes. The best ed. is by J. G. Schneider. "De venatione lib. iv et de piscatione lib. v" [Greek and Latin] Strasburg, 1776. A second ed. was issued, Leipsic, 1813. In these eds. Schneider argues that the poems are by different Oppians.

Many other pre-Linnæan eds. are extant, but of these only two will be listed.

— Halieuticks of the nature of fishes and fishing of the ancients, in v. books. Translated from the Greek, with an account of Oppian's life and writings, and a catalogue of his fishes, [by William Diaper and John Jones]. Oxford, 1722. 8°. Pre-Linn. 1722.1

The first two books treat of the nature of fishes and the others of the fishing of the ancients.

— Oppiano della pesca, e della caccia tradotto dal Greco et illustrato con varie annotazioni da Anton Maria

Salvini al Serenissimo Principe Eugenio di Savoia. Firenze, 1728. xvii, 510 p. 12°. Pre-Linn. 1728.1

Modern eds. in French & Italian are:

Les Halieutiques traduction du poème grec d'Oppian, où il traite de la pêche et des moeurs des habitants des eaux, par J. M. Limes. Paris, 1817. 8°.

Della pesca e della caccia; tradotto dal greco ed illustrato con varie annotazione da Antonmaria Salvini. Nuova ed., coll' aggiunta delle notizie sulla vita dell' autore per G. A. Greenhill. [Edited by Giulio Antimaco.] Milano, 1864. 16°.

Of all the ancient writers on fish and fishing, Oppian is easily the most important. His works on fishing have been so often translated, and so many times printed under varying titles, that it is difficult to set his bibliography in order. It seems not improbable that the works of two authors named Oppian have been confused. On this point, see Westwood & Satchell, 1883.1, p. 164, and note above concerning Schneider as editor.

Oribasius [c.325—c.400] Oribasii sardiani collectorum medicinalium, libri xvii, qui ex magno septuaginta librorum volumine ad nostram ætatem soli pervenerunt Ioanne Baptista Rasario, medico, Novariensi, interprete. Parisiis, 1555. Pre-Linn. 1555.1

Fishes as food in book ii, chaps. 48, 49, 50, 51, 52.

Oribasius was physician to the emperor Julian. He largely copied Galen and Zenocrates as to the names of fishes and the properties of their flesh as aliment.

"**Ortus Sanitatis.**" See Cube, Johann von (editor).

Osbeck, Pehr [1723–1805] Beschreibung eines Fisches, Lotse genannt [*Naucrates ductor*]. König. Schwed. Akad. Abhandl., 1755, 17, 72–75. Pre-Linn. 1755.1

See note under Kästner, A. G., above.

— Beskrifning om en fisk [*Naucrates*], som kallas Lods. K. Svensk. Vetensk. Akad. Handl., 1755, 17, 71–. Pre-Linn. 1755.2

— Beschreibung eines Fisches, Mal [*Silurus*]. König. Schwed. Akad. Abhandl., 1756, 18, 33–37. Pre-Linn. 1756.1

See note under Kästner, A. G.

— Beskrifning öfver fisken Mal [*Silurus*]. K. Svensk. Vetensk. Akad. Handl., 1756, 18, 33–37. pl. Pre-Linn. 1756.2

See also Osbeck, P. in vol. II.

— Dagbok öfver en Ostindisk resa åren 1750–52, med anmärkningar uti naturkundigheten, främmande folkslags språk, &c. (En Ostindisk resa til Surat, China, &c. Fran 1750 . . .

Osbeck, P.

til 1752 . . . förättad af O. Toren &c.)
Stockholm, 1757. vi, 376 p. 12 pls. 8°.
Pre-Linn. 1757.1

16 species of fishes are described.

For German and English versions of 1765 & 1771, see Osbeck, P. in vol. II.

Oudenhoven, Jac. van. Out-Holland nu Zuyt-Hollandt. Vervangende een generale beschryvinge, mitsgaders de privilegien, keuren, hantvesten, enz. Dordrecht, 1654. 8°. Pre-Linn. 1654.1

Contains considerable data on fish and fisheries, p. 28-34, 54, 275, 374.

Ovid, (Publius Ovidius Naso) [43 B. C.-17 A. D.]. For a sketch of Ovid's life and a list of works and editions, see Owen, S. G. in *Encyclopædia Britannica*, 11th ed., 1911, vol. XX, 386-390.

— Opera. Rome & Bologna, 1471.
Pre-Linn. 1471.1

Two separate eds. Numerous other eds. were published ante 1758, but only the following will be listed here: Venice, 1474 (H. E. H.); Milan, 1477, Parma, 1477 (H. E. H.); Vicenza, 1480 (H., S. C.); Venice, 1486 (H. W.).

Indexed in the Opera is: "Halieutica." This poem is included among the works of Ovid, but the authorship is attributed by some critics to Grattius Faliscus. Names are given of 53 kinds of fishes, and the list was published by Conrad Gesner in 1556 at Zurich with attempted identifications. Two editions may be listed here; the second by Gesner.

— Halieuticon poematicum Ovidii Nasonis. Lugduni, 1535.
Pre-Linn. 1535.1

— Halieuticon: hoc est, de piscibus libellus, multo quam antehac emendatior et scholiis illustratus . . . per Conradum Gesnerum. Tiguri [Zurich], 1556. 8°. Pre-Linn. 1556.1

"A fragment of 134 hexameters, formerly ascribed to Ovid, which will also be found in 'Grattii poetæ . . . de venatione,' 1534 & 1537; Lonicer, J. A. 'Venatus et aucupium,' 1582; and Lemaire N. E. 'Bibliotheca classica Latina,' 1819, etc., vol. cxxxiv. It has been critically examined by Theodor Birt, and pronounced a thistle intruding among the poet's flowers, in 'De halieuticis Ovidis poetæ falso adscriptis,' p. iv & 207. Berolini, 1878. 8°. The verses are also contained in 'Halieutica . . . ex recensione M. Hauptii.' Berlin, 1838." — Westwood & Satchell.

Oviedo y Valdez, Gonzalo Fernandez de [1478-1557] For some account of the man and his work, see Miall, L. C., 1912.1.

— Relacion sommario de la natural historia de las Indias. Toledo, 1525. fol. Pre-Linn. 1525.1

This, Oviedo's first work, was also issued in Italian, Venice, 1535. A modern reprint is: "Sumario de la natural historia de las Indias" (In "Biblioteca de autores españoles." Madrid, 1852, 22, 471-515.)

— Oviedo de la natural hystoria de las Indias, etc. Toledo, 1526. lij. 2 leaves. fol. Pre-Linn. 1526.1

For an elaborate disquisition on this work, see Harisse's "Bibl. Amer. Vet.," no. 139. See also J. R. Bartlett's "Catalogue of John Carter Brown's Library," and Ternaux's "Bibliothèque Americaine," no. 35. The text of Oviedo has been republished in Barcias' "Historiadores Primitivos," vol. I, and in the "Bibliotheca de Autores Españoles," vol. IV. An Italian version is included in Ramusio, vol. III, p. 44-74, and a summary in English will be found in Purchas, vol. III, p. 970, etc. A modern English reprint was published by Edward Arber in 1885. Probably the best edition of Oviedo is:

— Historia general y natural de las Indias, islas y tierra firme del mar océano, por el Capitan Gonzalo Fernandez de Oviedo y Valdés. Sevilla, 1535. 4 leaves, i-cxcij.
Pre-Linn. 1535.1

Oviedo's excellent history passed through a large number of editions and translations. Of these, Spanish eds. are, Seville, 1535; Salamanca, 1541, & 1547 under the title "Coronica de las Indias"; & Valladolid, 1557. In French, eds. were issued at Paris, 1555 & 1556; in Italian, 1556, 1561, & 1606 in Ramusio's collections.

Oviedo's "Historia natural" comprises 50 books. The "Sommario" of 1525 and the "Hystoria" of 1526 must be accounted as preliminary issues. The Seville "Historia" of 1535 comprised 19 books, and the 20th, completing the first section of the general work, is found in the Valladolid edition of 1557. The complete work was first published by the Real Academia de la Historia, Madrid, 1851-55. 4 vols. 4°.

Oviedo lived for twenty years in America, and his accounts of the fishes and other animals of the New World are among the best written at that time. His description of fishing with the remora is by far the most circumstantial and accurate of any of the early Spanish writers.

Copies of nearly all of Oviedo's works and editions are in N. Y. P.

An early English version is:

— Certeyne notable thynges gathered owte of G. F. Oviedus his book entiteled the summarie of his generall hystorie of the West Indies, by Richard Eden. London, 1555. 4°. Pre-Linn. 1555.1

Printed with Eden's version of Peter Martyr's "Decades," and like the latter reprinted in Edward Arber's "The first three English books on America." Birmingham, 1885.

Ovington, John [fl. 1689-1698] A voyage to Surratt, in the year 1689. London, 1696. 606 p. Pre-Linn. 1696.1

Fishes, p. 36, 45-49. Sleep of fish, p. 48. Fish fed to cattle, p. 425.

A French version is:

— Voyages faits à Surate, etc. 2 vols. 1725. xxiv, 323: 318 p. 12°. Pre-Linn. 1725.1

A Dutch edition appeared in 1729. The "Voyage" was also republished in Arkstee & Merkus, "Allg. Hist. Reisen," 1748, Bd. X.

P

Paciersio, Giacomo. Theatro della caccia et trattenimento geniale della villa. Nel quale si contiene la maniera, et arte d'uccellare, pescare, etc. Milano, 1669. iv, 100 p. Pre-Linn. 1669.1

With rude woodcuts. "Altra regola di pescare con la canna, et sedarina," p. 40-46.

Another ed., Bologna, 1673.

Palladius, Rutilius Taurus Aemilianus [fl. 4th cent.] De re rustica libri XIV. Parisiis, 1543. 8°. Pre-Linn. 1543.1

This work, which treats of fish and fishponds, is in the form of a farmer's calendar, and is mainly a compilation of Columella (q. v.) and other early writers on farming and fish rearing.

It is included in "Scriptores rei rusticæ" in various editions from 1472-1794, and in "Poetæ Latines minores" edited by Wernsdorf, 1794. See also Gesner, J. M., 1735.1.

It also appeared in many versions: Italian, Venice, 1528, 1560, & Verona, 1810; French, Paris, 1553 or 54, & 1844; German, Magdeburg, 1612; English (by T. Owen), London, 1803.

Palladius, Rutilius Taurus Aemilianus, Cato, M., & others. Libri de re rustica. Parisiis, 1533. 506 p. fol. Pre-Linn. 1533.1

Other eds.: Paris, 1543; Lugduni, 1549; Lipsic, 1794-95.

See also Cato, M., Varro, M. T., & others, Pre-Linn. 1533.1.

Panarolli, Dominici. Iatrologismorum seu observationum pentecostæ quinque, etc. Hanoviæ, 1654. Pre-Linn. 1654.1

Anguillæ jecur nyctalopes sanans, p. 104-105. Nympha monstrosa torpedinem repræsentans, p. 111.

Paravicinus, Basil. Del vivere delli Romani e di conservar la sanita de M. Alessandro Petronio Libri v. dove si tratta del sito di Roma, dell' aria, de' venti, dell' aque, de' vini, delle carni, de' pesci, di frutti, delle herbe e di tutte l'altre cose pertinenti al governo degli huomini, tradotti della lingua latina nella vulgare. Roma, 1592. 4°. Pre-Linn. 1592.1

Paré, Ambroise [1510-1590] Oeuvres complètes d'Ambroise Paré. Paris, 1575. Pre-Linn. 1575.1

The 1st ed. This very valuable work passed through 11 other French, 6 Latin, 6 English, 5 Dutch, and 5 German eds.; the latest French issue appearing in 1685. Most available today

in the 3 volume ed., Paris, 1840-41, copy of which is in N. Y. P.

In vol. III of this ed., Venins de la torpille, p. 318; murène, p. 330; pastenague, p. 332; unicorn (Xiphias & Gladius), p. 502-503. "La livre des animaux" contains little on fishes; but "Monstres marines" deals with a number of fish forms.

The section on poisons first appeared in the 1575 ed.; that on animals in 1579, while dates cannot be here given for the sections on marine monsters and the unicorn.

Parsons, James [1705-1770] Some account of the *Rana piscatrix* (Lophius). Phil. Trans. Roy. Soc., 1749 (1750), 46, 126-131. figs. Pre-Linn. 1750.1

Pasini, Antonio. Annotationi & emendationi nella tradottione dell' excell. P. A. Matthioli de' cinque libri della materia medicinale di Dioscoride Anazerbeo. Bergamo, 1591. vi, 252 p. 4°. Pre-Linn. 1591.1

Spanish & German eds.: Salamanca, 1586, & Frankfort, 1614. See also Dioscorides, & Matthiolus, in this section.

Passeri, Giambattista [1694-1780] Dissertatio de petrificatis agri Veronensis. Venetiis, 1753. 12°. Pre-Linn. 1753.1

— Istoria de fossili del pesarese e d' altri luoghi vicini, dissertatione I, nella quale si riferisce la storia della maggior parte de fossili, che nel territorio de quella citta si ritrovano. Pesaro, 1753. 12°. Pre-Linn. 1753.2

Eocene fishes of Monte Bolca.

Another ed., Bologna, 1775. (Agassiz.)

Paullini, Christian Franz [1643-1712] De singulari monstro marini. Ephemer. Acad. Nat. Cur., 1677, dec. 1, ann. 8, 79-80. Pre-Linn. 1677.1

Jonah and the fish called Lamia.

See also, Pfeiffer, S. A. this section.

— Cœnarum Helena, seu anguilla, juxta methodum et leges illustris Academiæ Naturæ Curiosorum, descripta, selectisque; observationibus et curiositatibus condita. Francofurti & Lipsiæ, 1689. 200 p. pl. 12°. Pre-Linn. 1689.1

Found also in Misc. Acad. Nat. Cur., 1695 & 1696, ann. 3 & 4, p. 115. Abstract in Valentini, M. B. "Historia litteraria . . . Academiæ Naturæ Curiosorum, etc." Gissæ Hassorum, 1708.

Paullini, C. F.

— De ovo quadrato. [Egg of ray or shark] Misc. Acad. Nat. Cur., 1701 & 1702, dec. 3, ann. 9 & 10, obs. 53, p. 85. Pre-Linn. 1701.1

Peacham, Henry [c.1576–1643] The compleat gentleman . . . also certain necessarie instructions concerning the art of fishing. London, 1627. sm. 4°. Pre-Linn. 1627.1

Other eds.: 1634 & 1661.

Use of fish in heraldry in 1634 ed.

Pechlin, Johannes Nicolaus [1646–1706] Piscem Jonæ deglutitorem non fuisse balaenam. Lubec, 1697. 4°. Pre-Linn. 1697.1

Perrault, Claude [1613–1688] For biographies, see Gaz. Med., Paris, 1848, 3. sér. 3, 291–331; and Journ. de Santé, Paris, 1902, 19, pt. 2, 81.

— Description anatomique d'un renard marin [*Alopecias vulpes*]. 1671–1757. 8 p. 2 pls. Pre-Linn. 1671.1

This paper contains what was long thought to be the earliest known figure and description of the spiral valve of a shark. An earlier is noted under Steno, N. 1664.1 & 2, this section. Perrault's paper has been published at least 15 times. Nine of these issues have entirely different sources of publication and are listed herein.

I. Mémoires pour servir à l'histoire naturelle des animaux. Paris, 1671–76. xii, 207 p. 31 pls. fol.

Other eds. bearing this title are, Paris, 1688, 1700; La Haye, 1731; Amsterdam, 1736, 1758.

II. Essais de physique. 3 vols. Paris, 1680. 8°.

Renard marin, vol. III, p. 218.

Another ed., 4 vols. Paris, 1688.

III. Description anatomique de divers animaux disséqués dans l'académie royale des sciences, etc. Paris, 1682. 4°.

The 1st ed. bearing this title is not known. An English version is:

IV. Memoirs for a natural history of animals. Containing the anatomical descriptions of several creatures dissected by the Royal Academy of Sciences at Paris. London, 1688. 4°.

Reissued, London, 1701, according to the catalogue of the British Museum (Natural History); 1702, according to Engelmann.

V. In Valentini, M. B. Amphitheatrum Zootomicum, 1720, pt. II, 82–84. pl. 65.

VI. Oeuvres diverses de physique et de mécanique. 2 vols. Leyden, 1721. 4°.

Alopecias vulpes, vol. II, p. 439.

VII. Mémoires de l'académie royale des sciences depuis 1666 jusqu'à 1699. Paris, 1733, 3, 117–124. 2 pls.

For notes on this revised ed. of Perrault's paper, see the three unnumbered pages following p. xx in this volume (3) cited.

German versions follow.

VIII. Zur natürliche Historie der Thiere dienliche Nachrichten. Nürnberg, 1753. 4°.

IX. Abhandlungen zur Naturgeschichte der Thiere und der Pflanzen. Nürnberg, 1757. gr. 4°.

Contains additional papers by Charas and Dodart.

For anonymous accounts of the dissection of this shark, see Anon. 743 & 769 (1667).

For a modern reprint of this much published memoir, see Perrault, 1866.1.

— Observation sur l'épée qui est au milieu du museau de poisson nommé espadon, dont les points ne sont pas adhérentes à la partie osseuse. Mém. Acad. Sci. Paris, 1686–1699 (1733), 2, hist., 48. Pre-Linn. 1733.1

Perrault, a distinguished architect, designer and builder of the colonnade of the Louvre, was also a physician and anatomist of parts. One of the founders of the Paris Academy of Sciences, he was one of its most active early members.

Petit, François Pourfour du. See Dupetit, F. P.

Petiver, James [c. 1658–1718] For a notice of Petiver's life, see in Trimen & Dyer's "Flora of Middlesex." London, 1869. p. 379–385.

— Musei Petiveriani centuriæ x. Animalia, plantas, fossilia ex variis mundi plagis advecta, ordine digesta, & nominibus propriis signata. London, 1695–1703. 96 p. 8°.

Pre-Linn. 1695.1

Some British freshwater fishes described.

— Gazophylaci naturæ et artis decades x, in quibus animalia quadrupedia, aves, pisces, reptilia, insecta, vegetabilia, corpora marina, etc. descriptionibus curtis et iconibus illustrantur. London, 1702–1706. 102 pls. fol. Pre-Linn. 1702.1

Some British and foreign fishes described.

— An account of animals and shells sent from Carolina to Mr. James Petiver, F. R. S. Phil. Trans. Roy. Soc., 1706, 24, 1952–1960.

Pre-Linn. 1706.1

Various forms of Glossopetras, p. 1960.

— De piscibus fluviatilibus Anglicanis; an account of our freshwater

fishes, viz., such as are found in lakes, meres, pools, ponds, or rivers. Mem. for the Curious, 1708, 127-134.

Pre-Linn. 1708.1

— *Pteri-graphia Americana*, icones continens, etc., cui adjiciuntur crustacea, testacea, aliaque animalia fere omnia ex insulis nostris Charibbæis. London, 1712. 20 pls. fol.

Pre-Linn. 1712.1

Some American fishes figured & described.

Petiver's original works, as and when published, were collected and bound together and issued under covering titles in two editions as follows:

Opera omnia ad historiam naturalem spectantia; or, *Gazophilacium*, containing several thousand figures of birds, beasts, plants, fishes, etc., with Latin and English names. 3 vols. London, 1764. fol. & 8°.

Figures of Brazilian fishes shown in pl. 68, etc.

Opera ad historiam naturalium spectantia; containing several thousand figures of birds, beasts, fishes, reptiles, insects, shells, corals and fossils, also of trees, shrubs, herbs, fruits, fungus, mosses, sea-weeds, etc., to which are now added 17 curious tracts. The additions corrected by James Empson. London, 1767. 2 vols. fol.

Peucer, Caspar [1525-1602] *Appellationes quadrupedum, insectorum, . . . piscium . . . quas cum P. Ebero collegit.* Lipsiæ, 1550. 8°.

Pre-Linn. 1550.1

This work passed through a number of eds.: Leipsic, 1559, & 1580; Wittenberg, 1551, 1556, 1558, 1563, & 1570.

Peucer, C., & Eber, P. See **Eber & Peucer.**

Peyer, Johannes Conrad [1653-1712] *De lepusculis, salmonum extis, intestino coeco, ventriculo anserino et renibus anserinis, etc.* *Ephemer. Acad. Nat. Cur.*, 1682 (1683), 2 dec., ann. 1, 199-205.

Pre-Linn. 1683.1

— *De rete mirabili.* *Ephemer. Acad. Nat. Cur.*, 1686 (1687), 2. dec., ann. 5, 355-358.

Pre-Linn. 1687.1

— *Anatomia anguillæ* (In Muralt, J. de. *Exercitationes medicæ, etc.* Amsterdam, 1688, p. 383.)

Pre-Linn. 1688.1

See Muralt, J. de, in this section.

— *Descriptio anatomica salmonis* (In Valentini, M. B. *Amphitheatrum Zootomicum.* Francofurti-a.-M., & Gissæ, 1720, 2. pt. 120-121. pl.)

Pre-Linn. 1720.1

— *De salmonum sexu.* (In his *Parerga anatomica*, vii, Lugduni, 1750.)

Pre-Linn. 1750.1

Pfeiffer, Sigismund August. *Dissertatio piscem Jonæ deglutitorum fuisse balænam.* Lubecæ, 1692. 4°.

Pre-Linn. 1692.1

— *Dissertatio apologetica piscem Jonæ deglutitorem fuisse balænam, opposita C. F. Paullini et J. H. Major aliisque Lamiae propugnatoribus.* Lübec, 1697. 3 pls. 4°. Pre-Linn. 1697.1

First title from Walbaum; second from Boehmer. Probably the same article.

Phile or Philetes, Manuel [1275-1345] *De animalium proprietate.* Venice, 1533.

Pre-Linn. 1533.1

Contains reference to some 15 fishes, mainly excerpted from Aelian.

1st ed. & in Greek. Other eds.: Leipsic, 1575; Heidelberg, 1596; Utrecht, 1730. The best ed., (copy, N. Y. P.), is:

— *De proprietate animalium*, edit Corneille de Pauw. Utrecht, 1730. 4°.

Pre-Linn. 1730.1

Best available in F. Lehrs & F. Dübner, "Poetæ bucolici et didactici" (Didot series. Paris, 1846).

Philo, —. *Philonis chronographi, arca tenplorum referata: ut & trinum marinum.* Augspurg, 1693. fol.

Pre-Linn. 1693.1

"Pisces aliquot Ponti Euxini, Propontidis & Archipelagi continet."

Not seen; title and comment from Artedi.

Picinelli, D. Filippo. *Mondo simbolico formato d'imprese scelte, spiegate, ed' illustrate.* Venetia, 1670. pls. fol.

Pre-Linn. 1670.1

First edition of this encyclopaedia, whose author was canon of the Lateran in Rome. The Latin version which follows was made by Augustinus Erath, a professor in the royal college of Wettenhausen.

— *Mundus symbolicus, in emblematum universitate formatus, explicatus, et tam sacris quam profanis eruditionibus ac sententiis illustratus; etc.* 2 vols. [in 1]. Coloniae Agrippinae [Cologne], 1681. 738; 276 p.

Pre-Linn. 1681.1

Fishes, vol. I, book vi, p. 432-475.

Copy, A. M. N. H. Other eds.: Cologne, 1687, 1694, 1715.

Piccolo, Francisco Maria. An extract of a memoir concerning the discovery of a passage by land to California with a map and description of that country . . . printed at Paris, [1702]. *Phil. Trans. Roy. Soc.*, 1708, 25, 232-240.

Pre-Linn. 1708.1

Mentions sea fishes of California observed by the Jesuits in 1697.

Pictorius, Georgius [fl. 1540] *Medicinæ tam simplices quam compositæ*

Pictorius, G.

ad omnes ferme corporis humani adfectus ex Hipp. Gal. Avic. Aegineta et aliis ordine alphabetico conscriptæ . . . Accessit . . . leporarium, quorundam animalium quadrupedum et avicularum continens naturas ac proprietates, rem medicam concernentes. Accedit Constantini Africani quoque de animalibus elegantissimus liber: et Lippii Collesis, Oppiani poetæ Halieuticon, sive de piscibus tractatus, etc. Basilæ, 1560. 57 p. 16°. Pre-Linn. 1560.1

— **PANTOPOLION**, continens omnium ferme animalium, plantarum et metallorum naturas, carmine elegiaco, item de avium, piscium, serpentum, radicum, herbarum, seminum, fructuum, aromatum, metallorum & gemmarum natura, item de apibus, cera, melle, & aliis. Basilæ, 1563. 8°. Pre-Linn. 1563.1

Piercandido Decembrio. See **Candidus**, *Decembris Peter*.

Piers of Fulham. Vayne conseytes of folysche love undyr colour of fyscheing and fowlyng. [MS. c. 1420]. Pre-Linn. 1420.1

This work, written about 1420, contains the first known reference (a very short one) to angling in England. See Marston, R. B., 1894.1; also Westwood & Satchell, 1883.1.

First printed in Hartshorne's "Ancient metrical tales," 1829, from a MS. in the library of Trinity College, Cambridge; and again by Blakey in his "Historical sketches," 1856. However, it is most available in "Remains of the early popular poetry of England; collected and edited by W. C. Hazlitt." London, 1856. vol. II, p. 1-15.

Pietre, Nic., & Guenault, Fr. Ergo pisces saxatiles euchymi. Paris, 1614. Pre-Linn. 1614.1

Title from Boehmer.

Pisides, George (*Bishop of Constantinople*) [7th cent.] Hexæmeron [Greek and Latin]. Geneva, 1614. fol. Pre-Linn. 1614.1

A poem dealing with the 6 days of creation. The Greek MS. is in Vienna Library.

Piso, Guilielmus (*Willem*) [1611-1678] De medicina Brasiliensi libri quatuor: I. De aëre, aquis, & locis. II. De moribus endemiis. III. De venenatis & antidotis. IV. De facultatibus simplicium. [Edited by Johann de Laet, and published as section I. of "Historia naturalis Brasiliæ."] Lugduni Batavorum, & Amstelodami, 1648. 122 p. figs. Pre-Linn. 1648.1

Pisces venenati, p. 44-45, with a figure of a poison toad-fish, called the "Niqui."

— De Indiæ utriusque de naturali et medica libri quatuordecim . . . Amstelædami, 1658. 13 leaves, 327 p.; 3 leaves, 39 p.; 226 p. ill. fol. Pre-Linn. 1658.1

"The first part of this folio bears title as follows: 'Historiæ naturalis et medicæ Indiæ Occidentalis,' and consists of Marcgrave's 'Natural History of Brazil' and Piso's 'Medicinal Plants of Brazil' interwoven to form five books . . . It covers 327 pages. Next comes Marcgrave's 'Tractatus Topographicus,' etc., 39 pages in length. Next, he incorporates Jacob Bondt's 'Historiæ naturalis et medicæ Indiæ Orientalis,' 160 pages, and concludes with his own 'Mantissa Aromatica,' 66 pages." — Gudger in Pop. Sci. Monthly, 1912, 80, 265.

Fishes, p. 47-74; 293-301.

Regarding Piso's alleged plagiarism from Marcgrave, Cuvier and Valenciennes speak as follows: "On ne voit pas comment quelques écrivains ont pu accuser Pison d'être plagiaire de Margrave; il lui rend, au contraire, partout justice dans ses deux éditions."

For a full discussion of the question of the relations between Piso and Marcgrave, and of the matter of plagiarism, see the article by Gudger referred to. See also note under Marcgrave, this section.

Plancus, Janus (**Bianchi, Giov.**) [1693-1775] Epistola de mola pisce [Ostracion] ad Josephum Martium Bononiensum. Arimini, 1741. fig. 4°. — Comm. Instit. Bonon., 1746, 2, 297-303; *Ibid.*, 1755, 3, 331-334. pl. — Hamburg. Mag., 1757, 18, 3-8. — Allg. Mag., — 9, 247. — Comm. Lips., — 5, 306. Pre-Linn. 1741.1

Comments on absence of pancreas.

Platearius, Johannes (*Medicus Salernitanus*) Expositio in Nicolai Myrepsi antidotarium. Venetiis, 1558. fol. Pre-Linn. 1558.1

"On trouve, dans cet ancien ouvrage, quelques détails peu importants sur un fort petit nombre de poissons." — Cloquet.

A very popular work in Italy. Nine other eds.: Venice; 1490-1602.

Platt, (Sir) Hugh [1552-c.1611] For a notice of Sir Hugh Platt and his "Jewell House," see Bigby's "Visions of the times of old," vol. I, p. 220.

— The jewell house of art and nature, etc. London, 1594. 232 p. 4°. Pre-Linn. 1594.1

Fishing methods and various recipes for catching fish.

Other eds.: London, 1613, 1653, 1673. Copy 1st ed., N. Y. P.

Pliny (*Secundus*), *Caius* [23 B. C.-79 A. D.] For a memoir, see Crichton, Andrew, in Jardine's Naturalist's Library (Selby's Natural History of Pigeons), vol. IX, 1835; 2nd issue, 1845-46. For commentaries on Pliny's

work, see Barbarus, H. 1778.1; Steier, A. 1912.1, 1913.1, 1913.2, Add. 1913.1. For an extended list of editions, translations, and commentaries, see Boehmer, G. R. "Bibliotheca Scriptorum Historiæ Naturalis." Leipsic, 1785, vol. I, pt. I, p. 186-211.

— *Naturalis historiæ.* Venice, 1469. fol. Pre-Linn. 1469.1

Published by John Spira. Unpaged, but containing 355 leaves with 50 lines to a full page.

Boehmer lists a doubtful ed. of 1461 at Venice, and quotes Haller as authority for an ed. of 1468 at Verona. It is generally accepted, however, that the above ed. (of which a copy is in the British Museum [Natural History]) is the *editio princeps*.

This, the most popular natural history ever published, as a whole or in separate books passed through a multitude of eds. *ante* 1758. There were 3 issued in 1470 and at least 2 each in 1472 and 1473. There were 23 eds. issued prior to 1492 and 31 prior to 1500, all in folio, and all published in northern Italy. At least 68 eds. were issued in the 16th century, and 27 in the 17th.

Early eds. in languages other than Latin are: Italian, Rome, 1473; Venice, 1476 (Florentine version); Venice, 1481: first German version, Frankfort, 1511. The earliest French version known to us is Lyons, 1562. fol., Du Pinet translator; the first English, London, 1585; the earliest Spanish, 1599; Dutch, Amsterdam, 1610.

The first illustrated ed., according to Walbaum, was the Venice folio of 1470, 1471 or 1472, published by N. Jenson (the figs. said to have been colored); according to Boehmer, the best illustrated ed. was Venice, 1513 (figs. by Alex. Benedict); and the next the Italian version, Venice, 1535.

The only titles available for any of the above are:

— *Bücher und Schriften von Natur, Art, und Eigenschaft aller Creaturen.* Frankfort, 1511. fol.

Pre-Linn. 1511.1

Reprinted, 1584, 2 vols. fol.

— The secrets and wonders of the worlde, a booke right rare and strange, containing many excellent properties given to man, beastes, fowles, fishes, serpents, trees, and plants, translated out of Frenche. London, 1585. 4°. (blk. letter.) Pre-Linn. 1585.1

This is possibly a paraphrase rather than an exact translation. Better known is the famous edition of 1601.

— *Plinies natural historie of the world, translated into English by Philemon Holland, Doctor of Physick.* 2 vols. London, 1601. Pre-Linn. 1601.1
2nd ed., London, 1635.

— *Libro nono de Cayo Plinio Segundo de la Historia Natural de los pescados del mar, de lagos, estanques y rios.* Dirigida al rey Don Felipe III, Rey de España é Indias. Madrid, 1603. 4°. Pre-Linn. 1603.1

— *Plinius van menschen, beesten, vogeln und visschen.* Arnheim, 1610. 4°. Pre-Linn. 1610.1

This is probably an incomplete version; a fuller one is:

— *Des wijdt-vermaerden natuurkondigers viif boecken, handelende van de nature . . . V: van de visschen, oesters, kreeften, enz.* Amsterdam, 1657. figs. 8°. Pre-Linn. 1657.1

Other famous Pre-Linnæan eds. are those of Paris, 1526 & 1543; Basel, 1539 & 1549; Leyden, 1561, 1582, & 1587. Others might be named, but the best of the early eds. is that issued at Leipsic in 1778 in Latin, in 8 vols. 8°, under the general editorship of J. G. F. Frantzius with the cooperation of Harduin, Barbarus, Pintani, Rhenani, Galenius, Dalechamp, Scaliger, Vossius, Gronow, and others.

The best modern French and English versions follow:

Histoire naturelle; traduction nouvelle par M. Ajasson de Grandsagne, annotée par M. M. Beudant, Brogniart, Cuvier, Daunou, etc. 20 vols. Paris, 1829-33. 8°.

A later French translation is that by M. Littré. 2 vols. Paris, 1848-50. 8°.

The natural history of Pliny. Translated with . . . notes and illustrations by . . . J. Bostock and H. T. Riley. 6 vols. London, 1855-57. 8°.

The natural history of fishes, vol. II, book ix, p. 358-475.

Copies of early eds. of Pliny in the U. S. are: 1469, Prin.; 1472, L. C., J. C., H., N. Y. P., Y., H. E. H.; 1479, S. C.; 1534, A. M. N. H.

Plot, Robert [1640-1696] For a sketch of Plot's life, see in Wood, Anth. a. "Athenæ Oxoniensis," etc. 4 vols. London, 1813-20; also in the 1705 edition of his works below.

— The natural history of Oxfordshire, being an essay toward the natural history of England. Oxford, 1677. 15 pls. fol. Pre-Linn. 1677.1

Fishes, p. 183-186; 205-210.

Reviewed in Phil. Trans. Roy. Soc., 1686-87 (1688), 16, 207-213.

— *Natural history of Staffordshire.* Oxford, 1686. 449 p. pls. fol. Pre-Linn. 1686.1

Fishes (migration of eels, etc.), p. 240-246.

— The natural history of Oxfordshire. Second ed., with large additions and corrections. Oxford, 1705. x, 366 p. 16 pls. map. Pre-Linn. 1705.1

Fishes, p. 179-195.

Lowndes notes an ed., 1710; but Agassiz gives dates as 1676, 1686, & 1705.

Pluche, Natalis (Noel Antoine) [1688-1761] For his life, see in Gaz. Litt. Europe, February, 1765.

— *Le spectacle de la nature, ou entretiens sur les particularités d'his-*

Pluche, N.

toire naturelle, qui ont paru les plus propres à rendre les jeunes gens curieux, et à leur former l'esprit. Paris, 1732-51, 8 vols., 192 pls. Pre-Linn. 1732.1

Fishes and fishing in vols. I & II.

The 1st ed. of one of the most popular natural history books ever written. Either as a whole or in parts, it passed through a great number of editions and translations. At least 42 are known, distributed as follows: French, 23; English, 7; German, 6; Italian, 4; Spanish and Dutch, 1 each. Of the 23 French eds., 8 were issued, Paris, 1732-1764; the 15 others at 8 cities scattered over France, 1733-1859.

Pluche's work was still being printed in France in the 19th century. Four eds. were issued at Tours, 1851-1859, for church schools.

Foreign versions are:

— Spectacle de la nature; or nature display'd, being discourses of such particulars of natural history as were thought most proper to excite the curiosity, and form the minds of youth. 9 vols. London, 1736-48. 200 pls. 8°. Pre-Linn. 1736.1

2nd English edition. First, 1735; 7 others, 1739-1786, London.

— Schouwtoneel der natuur, of samenspraaken over de byzonderheden der natuurlyke historie, etc. 10 deelen. s' Gravenhaage & Amsterdam, 1737-48. pls. 8°. Pre-Linn. 1737.1

The one Dutch version.

— Spettacolo della natura, esposto in vari dialoghi. 14 vols. Venezia, 1745. 12°. Pre-Linn. 1745.1

3rd Italian ed.: others, Venice, 1737, 1740, 1752.

— Schauplatz der Natur, oder Unterredungen von der Beschaffenheit und den Absichten der natürlichen Dinge. 8 parts. Nürnberg, 1746-70. pls. 8°. Pre-Linn. 1746.1

1st German version (of 1732 ed.); 6 others, 1746-1792.

Plumier, Charles [1646-1704] *Zoographia americana, pisces et volatilia continens, auctore R. P. C. Plumier.* [c. 1695] Pre-Linn. 1695.1

i. Poissons, oiseaux, lézards et insectes — 157 figures of fishes.

ii. Poissons d'Amérique — 100 figures of fishes.

iii. Poissons et coquilles — 80 figures of fishes.

These comprise 3 vols. of unpublished drawings of Martinique fishes, composed of 169 folio pages, preserved in the Bibliothèque Nationale, at Paris. Cuvier & Valenciennes state that these were once in the possession of M. E. Bloch, who refers to them in the preface of his *Ichthyology*. Many of these figures were reproduced by Bloch and Lacépède. For further data, see *Biog. Univ.*, t. XXXV, p. 95.

Plutarch [c. 46-120 A. D.] *De industria animalium, utrum terrestria an*

aquatica plus sapiant. Græce et Latine, Sim. Grynæo interprete. Basel, 1534. 8°. Pre-Linn. 1534.1

French ed., translated by A. P. de la Rochefoucault, Paris, 1557.

— Les oeuvres de Plutarque, qui sont les vies des hommes illustres & les oeuvres morales. 13 vols. Paris, 1574. 8°. Pre-Linn. 1574.1

The *editio princeps*, by H. Stephanus, appeared in 1572. Numerous other early eds. were issued.

The works of Plutarch, outside of the "Lives," are included under the group term "Morals" (*Moralia*). In later editions of the works the first item above is included in this group. The earliest English translations of the "Morals" are:

— Plutarch's *Morals*, translated into English by Philemon Holland, Doctor in Physicke. London, 1603. fol. Pre-Linn. 1603.1

— Plutarch's *Morals* translated from the Greek by several hands. 5 vols. London, 1684-94. sm. 8°. Pre-Linn. 1684.1

Reprinted, London, 1718. Abridged eds. were issued London, 1704 & 1707.

For present day English readers the "Morals" are best available in the Bohn ed. of 1882-88 (a revision of the 1684 version) and for Americans in the revision of the 1684 version by W. W. Goodwin, Boston, 1870.

Vol. III, book II, question 7 of the *Symposiacs* — "About the fish called Remora or Echeneis [as a shipholder]." Vol. V, p. 157-217, "Which are the more crafty, water animals or those creatures that breed on land"; p. 195-208, "Sagacity of fishes."

Pollux, Julius (*Grammaticus*) [*fl.* 2nd cent. A. D.] *Onomasticon decem libri constans; adjecta interpretatio Latina, etc.* 2 parts (in 1 vol.) Francofurti, 1608. 4°. Pre-Linn. 1608.1

— *Onomasticon Græce et Latine, etc.* Amstælodami, 1706. fol. Pre-Linn. 1706.1

Pollux, a Greek writer towards the close of the second century of our era, in one of the books of his "Onomasticon" tells us a good deal about fish and fishing. His book is a dictionary arranged according to subject matter.

Modern eds. in Greek are those by W. Dindorf, 1824, and I. Bekker, 1846.

Polo, Marco [c. 1254-1324] For a brief sketch of the travels of Marco Polo, a critical discussion of the various early editions of his book, and an excellent translation, see Marsden, William. "The travels of Marco Polo, a Venetian, in the 13th century," etc. London, 1818. roy. 8°. See also the article in *Encyclopædia Britannica*, vol. XXII, 1911, by Sir Henry Yule and C. R. Beazley.

— De le meravegliose cose del mondo. Venice, 1496. 8°.

Pre-Linn. 1496.1

The 1st Italian ed. Other imperfect or preliminary Italian eds. are known. The *editio princeps* (in Latin) was printed at Basel or Venice between the years 1484 and 1490.

Copies 1496 ed., B. A.; 1496 & 1500 eds., H. E. H.

Of the large number of editions and versions issued *ante* 1758, only 2 others will be listed here. For others, see Marsden (work cited).

— Marci Pauli Veneti de regionibus orientalibus libri III. Basel & Paris, 1532.

Pre-Linn. 1532.1

— The most noble and famous travels of Marcus Paulus . . . in the East partes of the world, etc. London, 1579.

Pre-Linn. 1579.1

1st English version. A modern one is:

The book of Marco Polo . . . concerning the kingdoms and marvels of the East. Newly translated & edited, with notes by Col. H. Yule. 2 vols. London, 1871.

This edition, revised and augmented by Henri Cordier, was republished, London, 1903. This latter is the greatest thesaurus of Polo learning to be found in any language.

This old traveller refers to fishing and fish eating by the various peoples among whom he travelled.

Polyhistor. See **Solinus**, C. J.

Pomet, Pierre [1658–1699] *Histoire générale des drogues, traitant des plantes, des animaux, & des minéraux; ouvrage enrichy de plus de quatre cent figures en taille-douce tirées d'après nature; etc.* Paris, 1694. pt. I, 304; pt. II, 108; pt. III, 116 p. fol.

Pre-Linn. 1694.1

First ed. of an esteemed work which was reprinted in 1735. An English translation first appeared in 1712, and one in German in 1717. The 3rd English edition is:

— A compleat history of druggs, written in French by Monsieur Pomet. London, 1737. 419 p. ills. 4°.

Pre-Linn. 1737.1

Ichthyocolla (fish glue), p. 285–286; fishes, 292–298. figs.

Pond, Arthur [1705–1758] Letter to the Right Honorable George, Earl of Macclesfield . . . concerning the stones mentioned [by F. Byam]. *Phil. Trans. Roy. Soc.*, 1755 (1756), **49**, 297–298. pl.

Pre-Linn. 1756.1

See Byam, F. 1756.1, in this section.

Pontoppidan, Erik (*Bishop of Bergen*) [1698–1764] For a sketch of his life and an estimate of his works, see article by Gjellerup, S. M., in *Danske Biographisk Lexikon*, 1899. vol. XIII.

— Det første forsøg paa Norges natuurlige historie forestillende dette kongeriges luft, grund, fælde, vande, växter, metaller, mineralier, steenarter, dyr, etc. 2 Deele. Kjøbenhavn, 1752–53. 30 pls. 4°.

Pre-Linn. 1752.1

The 2nd ed.; the first Danish ed., Hafniæ, 1752. This work by some bibliographers is dated 1751–53, by others, 1752–54. Another ed. appeared in 1754. German and English versions are:

— Versuch einer natürlichen Historie von Norwegen, worinnen die Luft, Grund und Boden, Gewässer, Metalle, Mineralien, Steinarten, Thiere, Vögel, Fische und endlich das Naturel, wie auch die Gewohnheiten und Lebensarten der Einwohner dieser Königreichs beschrieben werden. 2 vols. Kopenhagen, 1753–54. 367 & 536 p. 16 & 14 pls. 8°.

Pre-Linn. 1753.1

— The natural history of Norway, containing the soils, waters, minerals, beasts, birds, fishes, &c. London, 1755. fol.

Pre-Linn. 1755.1

Has a chapter on the sea-serpent, and an illustration of it on p. 196.

For other works by Pontoppidan, see in vol. II, and Addendum.

Post, Franz [1614–1680] *Theatrum rerum naturalium Brasilæ*, (*Libri Picturati A 32–35*). [c. 1643]

Pre-Linn. 1643.1

This collection of oil paintings of the plants and animals of Brazil, made by Franz Post in Brazil, brought back to Germany by Count Maurice of Nassau, collected and bound with an illuminated title page by Dr. C. Mentzel, is preserved in the great library of Berlin. For the history of these paintings, see Gudger, E. W. Add. 1912.1 (p. 268–272), and Mentzel, C., this section.

Preston, Charles. A general idea of the structure of the internal parts of fish. *Phil. Trans. Roy. Soc.*, 1697 (1698), **19**, 419–424. Pre-Linn. 1698.1

Prévost, Antoine François [1697–1763] *Histoire générale de voyages; ou, nouvelle collection de toutes les relations de voyages par mer et par terre.* Nouvelle édition. 25 vols. La Haye, 1747. pls. maps. Pre-Linn. 1747.1

Différentes espèces de poissons d'Afrique, I, p. 317; V, p. 70, 348; VI, p. 413, 528; du Sierra Leona, IV, p. 235; de la Chine, VIII, p. 390. L'Ouwa ou l'oiseau Pescheur, pêche chinoise, VIII, p. 106. Poissons du Groenland, XXV, p. 258–262. Poissons extra-ordinaires d'Amboine, XVII, p. 84–254. 485 figs. Pêche des morues, XXI, p. 517, 520; XXIII, p. 351; XXV, p. 259. Poissons des mers du Nord, XXII, p. 388–410; XXV, p. 266.

Title and notes from Bosgoed.

The 1st ed. Others are: English, London (4 vols.), 1745–47 (probably an abbreviated version); French, Paris, (15 vols.), 1746–59; Dutch, The Hague (11 vols.), 1747–50 & Amsterdam

Prévost, A. F.

(21 vols.), 1755-67; German, Leipzig (21 vols.), 1747-74; Spanish, Madrid (28 vols.), 1763-71.

Not seen, and not known whether the versions contain all the data of the 1st ed. This probable save in case of the English ed. noted.

Preyel or Preyeliu, Adam. *Artificia hominum ad miranda naturæ in Sinâ et Europâ, etc.* Francofurti, 1655. 12°. Pre-Linn. 1655.1

42 species of Chinese and European fishes are described.

This title is commonly cited as anonymous, but Gronow (p. 12), on the authority of Voigt, credits it as above.

Prueckmannus, Fredericus. See **Bruckmann, Fredericus.**

Purchas, Samuel [c.1577-1626] *Purchas his pilgrimage; or relations of the world . . . from the creation unto this present; in foure parts . . . etc.* London, 1613. 4°. Pre-Linn. 1613.1

This is the 1st ed. The 2nd, 1614; 3rd, 1617. Next comes:

— *Purchas his pilgrim, etc.* London, 1619. Pre-Linn. 1619.1

This was followed by Purchas's *magnum opus*:

— *Hakluytus posthumus, or Purchas his pilgrimes. Contayning a history of the world in sea-voyages and lande-travells by Englishmen and others.* 4 parts. London, 1625-26. fol. Pre-Linn. 1625.1

Notes on fishes scattered throughout.

Dutch version, Amsterdam, 1655. The only modern reprint was issued at Glasgow, 1905-07 in English.

Pyrard de Laval, François. *Voyage F. P. de Laval contenant sa navigation aux Indes Orientales, Maldives, Moluques, & au Brésil, etc.* Paris, 1579. Pre-Linn. 1579.1

Fishes and fishing, p. 6-8, 88, 136-141.

Other eds.: 1611, 1619. Available for English present-day readers as:

The voyage of F. Pyrard of Laval to the East Indies. 2 vols. Hakluyt Soc., Works, 1887-90, no. 76, 77, 80. 8°.

Q

Quercu, Leodegarius à, pseudonym for **Duchesne, Léger** [—1588] In *Ruellium de stirpibus epitome. Cui accesserunt volatiliu, gressiliu, pisciu, & placentarum, magis frequentium apud Gallias nomina.* Parisiis, 1539. 24 p. 12°. Pre-Linn. 1539.1

This work formed the basis of E. Estienne's "*De Latinis et Græcis nominibus arborum*," &c.

Another ed., with slightly different title is:

— In *Johannem Ruellium de stirpibus latino-gallica epitome, item volatiliu, gressiliu, pisciu, & plantarum apud Gallos magis frequentium nomina.* Rothomagi (Rouen), 1539. 8°. Pre-Linn. 1539.2

Other eds.: Paris, 1543 & 1544; Cadomi, 1549.

R

Rabanus, Maurus [c. 776–856] For brief sketch of Rabanus, and for a list of biographies and commentaries on his writings, see under his name in the Catholic Encyclopedia, 1911, vol. XII.

— De universo [Coloniæ Agripinæ, 1617] Pre-Linn. 1617.1

Fishes, book viii, chap. 5.

The "De Universo" is, in arrangement and method, a forerunner of the "Speculum" of Vincent de Beauvais. The date of the first printing is not certainly known, but there was an edition of Rabanus's collected works issued in 1617 or 1627, which has been reprinted and is available in Migne, J. P. "Patrologiæ cursus completus . . . series secunda, doctores scriptoresque ecclesiæ Latinæ, Tomus V, vol. 5," "De Universo," cols. 9–614. Paris, 1852.

Raimondi, Eugenio. Le caccie delle fiere armate e disarmate e degl' animale quadrupedi, volatili e acquatici. Brescia, 1621. xvi, 410 p. 4°.

Pre-Linn. 1610.1

The 4th book treats of fishes in 211 chapters. Other eds.: Napoli, 1626; Venetia, 1785.

Ramus, Jonas. Norriges bescrivelse. Kiøbenhavn, 1715. 4°.

Pre-Linn. 1715.1

With a catalogue of fishes and other animals and plants appended.

Ramusio, Giovanni Battista [1485–1557] For a brief sketch of his life and an exposition of his writings, see article by Sir Henry Yule in Encyclopædia Britannica, 11. ed., 1911, vol. XX, 882–884.

— Terzo volume delle navigatione et viaggi raccolto gia da M. Gio. Battista Ramusio nel quale si contengono . . . Si come si legge nelle diverse relationi, tradotte dal Ramusio di lingua Spagnuola & Francese nella nostra, & raccolte in questo volume. Venetia, 1565. 456 p. cuts. maps. fol.

Pre-Linn. 1565.1

— Della historia dell' Indie. Venetia, 1606. Pre-Linn. 1606.1

This contains some descriptions of West Indian fishes, and an account of fishing with the remora.

Ramusio's collection of "Navigationi e Viaggi" was one of the first and is still one of the most valuable of its kind. Issued separately in 3 volumes and in numerous editions, it is difficult to avoid confusion in setting the dates for

these. However, since the 3rd volume is devoted exclusively to voyages to the new world, it is of particular interest here and it only has been listed. It appeared in three editions, 1556, 1565, and last (and much augmented) 1606.

Rappolt, Carl Henr. Vom Abzuge der Heringe aus Preussen. Königsberg. Intelligenzwerke, 1739, no. 33. — Erläuterten Preussen, pt. 5.

Pre-Linn. 1739.1

Rasarius, Joannes Baptista [1517–1578] Xenocratis de alimento exaquatilibus animantium libellus, Græce nunc primum editus, imperfectus. Idem Latine perfectior, J. B. Rasario . . . interprete, &c. (In Dubravius, J. De Piscibus . . . libri quinque, &c. Zurich, 1559. 8°.) Pre-Linn. 1559.1

Rath, D. Hier. (præses) Disputatio de iure venandi, aucupandi et piscandi. (In Mor de Nigromonte, G. Pre-Linn. 1602.1., p. 128–144.) Pre-Linn. 1602.1

Jo. Ge. Haydenpuecher, respond.

Ray, John [1628–1705] For life and letters, edited by E. Lankester, see "Memorials of John Ray" (a republication with biological and critical notes by J. E. Smith, Cuvier, & Dupetit-Thouars, of "Select remains of . . . J. Ray, . . . with his life by W. Derham," London, 1760), and "The Correspondence of John Ray": found under Ray, J., 1846.1, & 1848.1. See also "Philosophical letters," 1718, below. For another memoir, see that by Jas. Duncan in Jardine's "Naturalists' Library," 1835 ed., vol. VIII; 1845–46 ed., vol. XXXIII; also in his (Duncan's) "Entomology," 1845–46, vol. VI. Also Boulger, George Simonds, "The life and work of John Ray, and their relation to the progress of science." Trans. Essex Field Club, 1885 (1886), 4, 171–188.

— Observations topographical, moral, & physiological made in a journey through part of the Low-Countries, Germany, Italy, and France, etc. London, 1673. xiii, 499, 115 p. 4 pls. ills. 8°.

Pre-Linn. 1673.1

Contains brief mention of glossopetras p. 116–117, and of swordfish fishing, p. 316.

Ray, J.

Other eds. are: 1678, 1693, 1738, 1746, 1758. The 1738 ed. consists of two volumes. The first is a reprint of the preceding work with a slightly changed title; the second is a "Collection of Curious Travels," of no interest here save that it contains the travels in Greece of Alpinus. (q. v.) This "Collection" was first printed separately, London, 1693.

— A collection of English words not generally used, . . . in two alphabetical catalogues; with catalogues of English birds and fishes, etc. London, 1674. 178 p. 16°. Pre-Linn. 1674.1

Contains a catalogue of fresh-water fishes found in England.

A second ed., enlarged, 1691. Said to have been republished in Ray's "Proverbs," 4th ed., 1768, the first ed. of which seems to have appeared in 1670.

— A letter written to the publisher by the learned Mr. Ray, containing some considerations on the conjecture in numb. 114, of these tracts, about the swimming bladders in fishes. Phil. Trans. Roy. Soc. 1675, 10, 349–351. Pre-Linn. 1675.1

Erroneously ascribed by Gronow and others to Robert Boyle, and listed under his name because the "conjecture in numb. 114" was "illustrated by an experiment of Mr. Boyle's."

— F. Willughbeii . . . de historia piscium libri quatuor . . . Totum opus recognovit . . . librum etiam primum & secundum integras adjecit J. Raius. Oxonii, 1686. v, 343, 30, 13 p. 188 pls. Pre-Linn. 1686.1

This great work of his pupil Willughby, left in MS. at his death, was edited and published by Ray, to whom much of the credit is due.

2nd ed., London, 1743. fol. See also Willughby, F., this section.

— De lingua piscium . . . de piscibus in genere, etc. (in) Appendix ad historiam naturalem piscium (In Willughby, F. De historia piscium. Oxonii, 1686) p. 8–13. Pre-Linn. 1686.2

— The wisdom of God manifested in the works of the creation, etc. London, 1691. 8°. Pre-Linn. 1691.1

Air-bladders of fishes an adaptation to their environment.

This work passed through many eds. (the 12th, 1759) and translations: French, Utrecht, 1714; German, Goslar, 1718, Leipsic, 1732; Dutch, Amsterdam, 1732, 1768.

— Synopsis methodica avium & piscium; opus posthumum: quod vivus recensuit & perfecit ipse auctor, in quo multas species in ipsius ornithologia & ichthyologia desideratas adjecit, methodumque suam piscium naturæ magis convenientem reddidit. Londini, 1710. pls. 8°. Pre-Linn. 1710:1

Later eds. are: 1713, 1721; & in Dutch, Amsterdam, 1769.

— Philosophical letters between the learned Mr. Ray and several of the ingenious correspondents; to which are added those of Francis Willughby Esq. The whole consisting of many curious discoveries and improvements in the history of Quadrupeds, Birds, Fishes, Insects, Fossiles, Fountains, &c. London, 1718. 376 p. 8°.

Pre-Linn. 1718.1

"Opus est posthumum a W. Derham in lucem editum, continens varia ad historiam naturalem & physicam spectantia." Title and comment from Gronovius.

Réaumur, René Antoine Ferchault de [1683–1757]. Observations sur la matière qui colore les perles fausses, etc., à l'occasion de quoi on essaie d'expliquer la formation des écailles des poissons. Mém. Acad. Sci. Paris, 1716 (1718), 229–244. Pre-Linn. 1718.1

The suggestion is here made for the first time that the concentric circuli of scales represent successive increments of scale growth.

— Des effets que produit le poisson appelé en français torpille, ou tremble, sur ceux qui le touchent; et de la cause dont ils dépendent. Mém. Acad. Sci. Paris, 1714 (1741), 344–360. — Journ. Scav., 64, 620. 2 pls. Pre-Linn. 1741.1

— Description d'un poisson d'une configuration monstrueuse. Mém. Acad. Sci. Paris, 1747, 52. Pre-Linn. 1747.1

— Divers means for preserving from corruption dead birds, . . . quadrupeds, reptiles, fishes and insects. Phil. Trans. Roy. Soc. 1748 (1750), 45, 304–320. Pre-Linn. 1750.1

Fishes considered, p. 319.

The original of this not found. Probably it is a translation of a French memoir sent direct to the Royal Society. This article has been reviewed or reprinted in abstract form many times. Boehmer (Vol. II, pt. I, p. 415) gives a list of 12, but most of them are obscure publications and probably are not to be found today.

Recchi, Nardo Antonio (editor and commentator). See **Hernandez, Francisco**.

Reck, Mord. von der. Disputatio juridica de piscatione. Solenniter defendendam suscepit M. von der Reck. Argentorati, 1662. 12 p. 4°. Pre-Linn. 1662.1

Redi, Francesco [1626–1698] For a life of Redi, see Salvini, A. S. in Opere, 1712–30, vol. I, pt. I. Also short notices in Locy, W. A. "Biology and its makers." 1908, p. 277; and Miall,

L. C. "The early naturalists." 1912, p. 225.

— Esperienze intorno a diverse cose naturali e particolarmente a quelle che ci sono portate dall' Indie fatte da Francesco Redi e scritte in una lettera al Reverendissimo Padre Atanasio Chircher della Compagnia di Giesuæ. Firenze, 1671, 47–51. Pre-Linn. 1671.1

The same, another ed., 1686.

— [Reference to his dissection of a Torpedo, "to see whether he could discover the seat and cause of its stupefactive [electric] power," and remarks on the curious form of the iris in this species] (In a review of his "Esperienze intorno a diverse cose naturali, & particolarmente a quelle che ci son dall' Indie." Firenze, 1671. — Phil. Trans. Roy. Soc. 1673, 8, 6003.)

Pre-Linn. 1673.1

— Osservazioni . . . intorno agli animali viventi che si trovano negli animali viventi. Firenze [Florence], 1684. iii, 253 p. 26 pls. 4°.

Pre-Linn. 1684.1

Life history of eel.

Another ed., Naples, 1687; and in "Opere," 1741, vol. I, no. 4. A Latin version is:

— De animalculis vivis quæ in corporibus animalium viventium reperiuntur, observationes. Amsterdam, 1708. figs. 12°. Pre-Linn. 1708.1

These papers also found in "Opere"; Venice, 1687, 1712–30, 1742; Naples, 1740–41 (best ed. 7 vols. ill. 4°).

Reisch, Gregory (compiler) [c. 1467–1503] For a biographical sketch, see Hartfelder in Zeitschr. Gesch. Oberheins, Freiburg, 1880, n. F. 5, 170–200. For bibliographical data about the various editions of Reisch's work, see Sabin.

— Margarita philosophica. Heidelbergiæ, 1496. 4°.

Pre-Linn. 1496.1

Some fishes are described.

This is a little library or "Circle of the Sciences" according to the theological ideas of the 15th century, in XII books, compiled by Gregory Reisch, prior of the Carthusian monastery near Fribourg.

First published in 1496, other eds. followed in quick succession: Fribourg, 1503 & 1504; Strasburg, 1504, 1508, 1512, & 1515; Basel, 1508, 1517, 1535 & 1583; & Venice, 1599. This last is the first and only version in a foreign tongue.

Copies, 1st ed., H., Col., A. G. S., N. Y. P. This last library has five other editions also.

Reiske, Johannes [1641–1701] De glossopetris Luneburgensibus ad virum nobilissimum & epertissimum Joh. Georgium Hieronymum epistolica con-

sideratio. Lipsiæ, 1684. 56 p. 2 pls. 4°.

Pre-Linn. 1684.1

— Commentatio physica æque ac historica de glossopetris Luneburgensibus. Norimberg, 1687. 84 p. pls. 8°.

Pre-Linn. 1687.1

Renard, Louis. Poissons, écrevisses et crabes . . . que l'on trouve autour des isles Moluques, et sur les côtes des terres Australes . . . Ouvrage . . . qui contient un très grand nombre de poissons . . . de la mer des Indes: divisé en deux tomes, dont le premier a été copié sur les originaux de M. B. Coyett . . . Le second tome a été formé sur les recueils de M. A. Vander Stell . . . avec une courte description de chaque poisson . . . Donné au public par . . . L. Renard, &c. 2 vols. [in 1] Amsterdam, 1718–19. xviii, 100 col. pls. fol.

Pre-Linn. 1718.1

The half-title reads: "Histoire naturelle des plus rares curiositez de la Mer des Indes."

Contains crudely drawn and barbarously colored figures of 459 East Indian fishes. A few short and defective descriptions are found.

Another ed., or better reissue, Amsterdam, 1754. fol.

For a discussion of the authorship of this work, see Cuvier & Valenciennes, vol. I, p. 86–87. Also Ebert. Bibliog. Lexicon, 1821, vol. I, 789.

See also in this section: Coyett, B.; Fallours, S.; Van der Stell, A.; and Vlaming, C. de.

Rhanæus, Samuel. Von einigen merkwürdigen Fischen in Curland. Act. Breslav. Natur & Kunstgesch., 1725, Tentam 31, 175.

Pre-Linn. 1725.1

"1) Von einem grossen Hechte. 2) Von andern grossen Fischen als Rehbsen, Steinbütten, Strömlingen. 3) Die berauschende Barsche. 4) Die unvermuthete Karpfen. 5) Die tödlichen Aale."

Rhodius, Jno. [c. 1587–1659] Jecur lampetræ rubrum, itemque viride. (In his Mantissa anatomica, published in Bartholin, Thomas. Historiarum anatomicarum et medicorum. Copenhagen, 1661, vol. V, 15–16).

Pre-Linn. 1661.1

Not seen; title from Cloquet.

Rhumelius, Jo. Conr. Philosophia animalis vivario, aviario, natatorio recessita carminice scripsit. Norimbergæ, 1630. 8°.

Pre-Linn. 1630.1

Richardson, Richard [1663–1741] For data concerning this man and his works, see Turner, A. D., "Extracts from the literary and scientific correspondence [and a memoir] of R. Richardson." 1835. 8°.

Richardson, R.

— Several observations in natural history, made at North-Bierley in Yorkshire, . . . Communicated in a letter to Dr. Hans Sloane, R. S. Secr. Phil. Trans. Roy. Soc. 1714, **28**, 167–171. Pre-Linn. 1714.1

Observations on tench living for several days out of water; and on small size of trout and charr in mountain streams and lakes of Wales.

— Part of a letter to Sir Hans Sloane concerning the *Squilla aquæ dulcis*. Phil. Trans. Roy. Soc., 1734, **38**, 331–332. Pre-Linn. 1734.1

Destruction of fish fry by an insect larva.

Richer, Jean [–1696] Observations astronomiques et physiques faites en l'isle de Caienne. Mém. Acad. Sci. Paris, 1666–1699 (1729), **7**, 233–326. Pre-Linn. 1729.1

Remarks on *Gymnotus*, p. 325.

Richter, Ge. Gottlieb. Progr. de piscium saluari cibo. Göttingen, 1752. 3 pl. 4°. Pre-Linn. 1752.1

Abstract in his Opusc. Medicin., vol. III, p. 216.

Richter, Johann Gottfried Ohne-falsch. Ichthyothologie, oder: Vernunft- und schriftmässiger Versuch die Menschen aus Betrachtung der Fische zur Bewunderung, Ehrfurcht und Liebe ihres grossen, liebreichen und allein weisen Schöpfers zu führen. Leipzig, 1754. xxxii, 912, xxxii p. pls. 8°. Pre-Linn. 1754.1

25 freshwater fishes referred to in the Bible are described and common European names set for them.

A Dutch version is entitled:

Vischkundige onderwijser, in eene beschrijving der visschen, etc. Dordrecht, 1780. 319 p. 4°.

Rierner, J. de. Beschrijving van 's Gravenhage. Delft, 1730. 3 parts. pls. fol. Pre-Linn. 1730.1

Contains data about the fisheries and fishing industry at Scheveningen, pt. i, p. 50–59.

Rittershusius, Conrad [1560–1631] Catalogus doctorum virorum, qui præter Oppianum de venatione et piscatione, aut rebus ad eam pertinentibus scripserunt. (In his Prolegomena in Oppianum. Lugduni Batavorum, 1597, leaves 74 & 75). Pre-Linn. 1597.1

Rivière, M. Sur les dents pétrifiées de divers poissons comparées avec les dents des mêmes poissons nouvellement pêchés. Mém. Acad. Sci. Lettres Montpellier, 1708, **1**, 75–84. Pre-Linn. 1708.1

In German: Mineral. Belustig., pt. II, 283. — Vorräthe Auserlesener Aufsätze, pt. III, 737.

Rivinus, Augustus Quirinus [1652–1723] Observatio anatomica circa poros in piscium cute notandos. Acta Erudit. Lips., 1687, **6**, 160–162. Pre-Linn. 1687.1

Roberg, Laurentius (præses) Dissertatio medico-physica de piscibus . . . submittit alumnus regius . . . Upsaliæ, 1727. 26 p. figs. 12°. Pre-Linn. 1727.1

Johann Gabriel Gering, respond.
Anatomy described for *Lampetra*, *Anguilla*, *Silurus*, *Acus*, *Asellus*, *Salmo*, *Spirinchus*, and *Albula*.

— (præses) Dissertatio de salmonum natura, eorumque apud Ostrobothnienses piscatione. Upsala, 1730. 27 p. fig. 4°. Pre-Linn. 1730.1
Dan. Bonge, respond.

— Anatomia piscium figuris multis illustrata. (In Klein, J. T. Historia piscium naturalis provomendæ. Gedani, 1749, missus v, p. 2.) Pre-Linn. 1749.1

According to Gronovius, Klein received this in MS. from J. G. Waller and published it as noted.

Robinson, Tancred [–1748] (Notes on various fishes) [in] Appendix ad historiam naturalem piscium. (In Willughby, F. De historia piscium, etc. Oxonii, 1686. fol.) p. 27. Pre-Linn. 1686.1

— Miscellaneous observations made about Rome, Naples, and some other countries in the year 1683 & 1684. Phil. Trans. Roy. Soc., 1715 (1717), **29**, 473–483. Pre-Linn. 1717.1

Treats of fishes among other things.

Rocheport, César de [1630–1691] Histoire naturelle et morale des îles Antilles de l'Amérique. Enrichie de plusieurs belles figures des raretez les plus considérables qui y sont décrites. Avec un vocabulaire Caräibe. Rotterdam, 1658. 527 p. 43 pls. 4°. Pre-Linn. 1658.1

Editio princeps of a valuable work; not seen. The dedication is signed "L. D. P." (i. e. Louis de Poincy); the book, however, was compiled by de Rocheport, whose name appears in the subsequent eds. Du Tertre avers that the bulk of the work was taken, errors included, from his own book, which appeared in 1654. Boehmer says there was an ed. at Rotterdam, 1639, but this seems to be an error. Often reprinted and translated, some titles of which follow.

The "Vocabulaire Caräibe" is by Père Raymond Breton (q. v. 1665.1 this section).

— *Natuurlyke en zedelyke historie van d'eylanden der Voor-Eylanden en America, etc.* Rotterdam, 1662.

Pre-Linn. 1662.1

— *Histoire naturelle et morale des îles Antilles de l'Amérique. Enrichie d'un grand nombre de belles figures en taille douce, des places et des raretez les plus considérables, qui y sont décrites. Avec un vocabulaire Caräibe,* Rotterdam, 1665. xviii, 583 p. pls. ills.

Pre-Linn. 1665.1

Fishes, p. 183-200.

The 2nd French ed., & probably the best. Others are: Rotterdam, 1681; Rouen, 1665; Paris, 1666; Lyons, 1667; Amsterdam, 1716. Dutch versions are: Rotterdam, 1658 & Frankfort, 1668.

— *The history of the Caribby-Islands, viz. Barbados, St. Christopher, St. Vincent's, Martinico, Dominico, Barbouthos, Monserrat, Nevis, Antego, etc., in all xxviii. In two books. The first containing the natural; the second, the moral history of those islands. With a Caribbian vocabulary. Rendered into English by John Davies of Kidwelly.* London, 1666. sm. fol.

Pre-Linn. 1666.1

Fishes, p. 97-106. Copy N. Y. P.

The rare first English version of the anonymous French edition of 1658, often catalogued under the name of the translator.

— *Historische Beschreibung der Antillen-Inseln in Amerika gelegen, etc.* Frankfort, 1668.

Pre-Linn. 1668.1

— *Relation du voyage de l'Isle Tabago.* Paris, 1666. 8°.

Pre-Linn. 1666.2

Fishes, p. 36-37. Copy, N. Y. P.

Inserted here to avoid breaking continuity of the above.

Røede, Christ. (*præses*) *Dissertatio de pisce, qui Jonam deglutivit, cujusnam speciei fuerit?* Hafniæ, 1740. 4°.

Pre-Linn. 1740.1

Frid. Colbiörnsen, *respond.*

Ronaudot, Eus., & Le Tellier, Pet. See **Le Tellier & Ronaudot.**

Rondelet, Gulielmus [1507-1566] For sketches of the life of this author, see memoir by R. Hamilton, in *Jardine's Naturalist's Library*, 1845-46, vol. XXXVIII. Also *Planchon, J. E.* "Rondelet et ses disciples," etc. *Montpellier*, 1866. 72 p. 2 pls. Also *Kingsley, G.* "Sketch of the life of Rondeletius," in "Good Words." Sept. 1868.

— *Libri de piscibus marinis, in quibus veræ piscium effigies expressæ*

sunt. Quæ in tota piscium historia contineantur, indicat elenchus pagina nona et decima. Postremo accesserunt indices necessarij. Lugduni [Lyons], 1554. 14, 583, 23 p. ills. portrait. fol.

Pre-Linn. 1554.1

The first four books have to do with the external and internal anatomy, the faculties and habits of fishes and the modes of capturing them. In the remaining books are described the fishes known to Rondelet. Although the title says "marine fishes," 47 freshwater fishes are described as against 197 marine.

— *Universæ aquatiliæ historiæ pars altera, cum veris ipsorum imaginibus. His accesserunt indices necessarij* Lugduni, 1555. 10, 242, 9 p. ills. portrait. fol.

Pre-Linn. 1555.1

This work is ordinarily considered as vol. II of the "Libri de piscibus marinis," but it has a separate title page and was published a year later than that work. Konrad Gesner included it in his "Historiæ animalium, liber IV," 1558. These two volumes, translated into French, next appear under the title below. They are, however, paged separately.

— *La première (et seconde) partie de l'histoire entière des poissons.* Lion, 1558. 9, 418, 20, 181, 8 p. ills. portrait. fol.

Pre-Linn. 1558.1

In 1558, Franciscus Boussuet published at Lyons two poems entitled "De natura animalium." Since his facts were obtained from Rondelet and the figures of "De piscibus marinis" were used as illustrations, these books are sometimes listed under Rondelet, but they are individual productions of, and are herein listed under Boussuet, (*q. v.*).

Rongeard, —. *Observations sur les vers des tanches.* 1723. 4°.

Pre-Linn. 1723.1

Rosenhane, Gust. *Respublicæ glacialis seu de hiberna piscatione apud Suecos.* Stockholm, 1681. 12°.

Pre-Linn. 1681.1

Rousseau, Cl. *Edicts et ordonnances, arrêts et réglemens des eaux et forests, revues et augmentez d'anciens et nouveaux, avec annotations sommaires.* Paris, 1633. 8°.

Pre-Linn. 1633.1

French laws relating to freshwater fisheries.

Rudbeck (junior), Olaus (*præses*) [1630-1702] *Ichthyologiæ biblicæ pars prima, de ave selav, cujus mentio fit num. xi: 31, in qua contra Bochartum & Ludolfum non avem aliquem plumosam, nec locustam fuisse, sed potius quoddam piscis genus (piscis volatiles) manifestis demonstratur argumentis.* Upsaliæ, 1705. 148 p. figs. 4°.

Pre-Linn. 1705.1

Andrew Brodd, *respond.*

Rumpf, or Rumphius, George Everhard [1626–1693] For a sketch of his life, see Henschel, A. W. E. T. "Vita G. E. Rumphii . . . accedunt specimen materiæ Rumphianæ medicæ clavisque herbarii et thesauri Amboinensis," &c. 1833. 8°. Also issued under the title "Clavis Rumphiana botanica et zoologica, accedunt vita G. E. Rumphii." For bibliography, see Rouffaer, G. P., & Muller, W. C., 1902.1. With reference to the fate of Rumpf's collections, see Martelli, U., 1903.1; also Targioni-Tozzetti, G., 1903.1

— D'Amboinsche rariteitkamer, behelzende eene beschryvinge van allerhande zoo weeke als harde schaalvischen, te weete raare krabben, kreeften, en diergelyke zeedieren, als mede allerhande hoorntjes en schulpen, die men in d'Amboinsche zee vindt. Amsterdam, 1705. xxviii, 340 p. 60 pls. ills. fol. Pre-Linn. 1705.1

Chap. LXXXII, Dominees Steen. In pl. 59 are shown figures of *Palæoniscus freieslebeni*, from the Permian, and of *Leptolepis* from the lithographic stone of Solenhofen.

This work as a whole or in its parts was often reprinted in Dutch and in various versions. Some editions of the original work are: Amsterdam, 1741; Wien, 1766. The best known Latin version is:

— Thesaurus imaginum piscium testaceorum, quales sunt cancri, echini, &c. Lugduni Batavorum, 1711. 4, 15, 8 p. 60 pls. fol. Pre-Linn. 1711.1

Consists of the plates only, with names of the animals in Latin and Dutch. The fossil fishes above referred to are included.

Another ed., The Hague, 1739.

— Het Amboinsche kruid-boek, etc. G. E. Rumphii . . . Herbarium Amboinense, etc. 6 parts (in 4 vols.). Amsterdam, 1741–1755.

Pre-Linn. 1741.1

Not seen; apparently a Dutch-Latin version of the above.

Rumpler, Angelus (Abbot of Vormbach-am-Inn) Geschichte des Klosters zu Vormbach. [M. S. c. 1500.]

Pre-Linn. 1500.1

According to J. Wimmer in his "Geschichte des deutschen Bodens," p. 389–392, an interesting account of Bavarian fishes is contained in this work.

Russell, Alexander [c.1715–1768] An account of four undescribed fishes of Aleppo. Phil. Trans. Roy. Soc. 1756, 49, 445–449. Pre-Linn. 1756.1

Three are silurids. No scientific names are assigned. Descriptions and figures of these also found in:

— The natural history of Aleppo, and parts adjacent. Containing a de-

scription of . . . the principal natural productions in its neighbourhood, etc. London, 1756. viii, 266, 10 p. 16 pls. 4°. Pre-Linn. 1756.2

Abstracted and reviewed in Com. de Rebus, 7. — Leipz. Gel. Anz., 1757. — Gött. Gel. Anz., 1757.

A second ed. (revised & enlarged by P. Russell) in 2 vols., illust. London, 1794 (fishes, vol. II, p. 207–219, pl.). German version, "Naturgeschichte von Aleppo." Göttingen, 1797–98.

Ruysch, Fredericus [1638–1731] The-saurus animalium primus . . . Het eerste cabinet der Dieren. Amstelœdami, 1710. lvi, 40 p. 7 pls.

Pre-Linn. 1710.1

11 Asiatic & African fishes described. Latin and Dutch in parallel columns. Copy in A. M. N. H.

— Descriptio anatomica rajæ, (In Valentini, M. B. Amphitheatrum Zootomicum, 1720, pt. II, 125. pl. 74.)

Pre-Linn. 1720.1

Ruysch, Henricus (filius Frederici) [—1727] Theatrum universale omnium animalium . . . ex scriptoribus tam antiquis quam recentioribus . . . a J. Jonston collectum, ac plus quam trecentis piscibus nuperrime ex Indias orientalibus allatis . . . cum enumeratione morborum . . . ac notitia animalium . . . cura H. Ruysch, etc. 2 vols. (in 1). Amstelodami, 1718. fol. Pre-Linn. 1718.1

Fishes found in vol. I. only.

For the most part an edition of Jonston. (q. v.)

— Collectio nova piscium Amboinensium partim ibi ad vivum delineatorum, partim ex museo Henri Ruysch M.D. xx tabulis comprehensa (in his Theatrum universale omnium animalium, etc. Amstelodami, 1718). 40 p. 20 pls.

Pre-Linn. 1718.2

This is Ruysch's own part of the "Theatrum universale," but it is mainly taken from Renard and Valentyn. The figures are gross caricatures. See also Jonston, J., this section.

Rzaczynski, Gabriel [—1737] Historia naturalis regni Poloniae, magni Ducatus Lithuaniae, annexarumque provinciarum, in tractatus xx divisa, etc. Sandomiriæ, 1721. 456 p. sm. 4°. Pre-Linn. 1721.1

De fluminibus et piscibus. p. 131. De lacubus, piscibus, etc. p. 153.

— Auctarium historiæ naturalis curiosæ regni Poloniae. 12 parts. Gedani, 1736. 4°. Abstract in Erlang. Gel. Zeit., 1755. Pre-Linn. 1736.1

Other eds., Gedani, 1742 & 1745.

S

S., J. The true art of angling; or the best and speediest way of taking all sorts of fresh-water fish with the worm, fly, paste and other baits in their proper seasons; how to know the haunts of fish and angle for them in all waters and weathers, at the top, middle and bottom, baiting of the ground and night baits, oyls and oyntments, baits natural and artificial; the several ways of angling; . . . and many rare secrets never before made publick; containing the whole body of angling, and mystery of a compleat angler. London, 1696. vi, 160 p. 24°. Pre-Linn. 1696.1

This passed through at least 12 eds., in part under the above title, but mostly changed as below. The second ed. "The true art of angling," etc. London, 1697, like the above, is extremely rare. The third ed. is:

— The compleat fisher, or the true art of angling; being a clear and speedy way of taking all sorts of freshwater fish . . . containing the . . . mystery of a compleat angler, etc. London, 1704. vi, 160 p. 24°. Pre-Linn. 1704.1

This was followed by eds. bearing same title; London, 1716, 1725, 1740, & 1770 (12th and last ed.) as "The true art of angling."

This author is believed to have been John Smith (*q. v.*, this section) and these titles are listed under his name in the Heckscher sale catalogue. See also, further in Westwood & Satchell under both authors.

Sagard-Theodat, F. Gabriel [*fl.* 17th cent.] *Le grand voyage du pays des Hurons, situé en l'Amérique vers la mer douce, és derniers confins de la nouvelle France, dite Canada . . . De la chasse, de la pesche & des oyseaux & animaux terrestres & aquatiques, etc.* Paris, 1632. 380 p. 16°. Pre-Linn. 1632.1

A practically new edition was issued, Paris, 1636, as "Histoire du Canada," etc. A modern reprint appeared in 1865.

Sainctyon, —. Les édicts et ordonnances des roys, coustumes des provinces, réglemens, arrests et jugemens notables des eaux et forêts. 3 vols. Paris, 1610. fol. Pre-Linn. 1610.1

Early French laws governing fishing in fresh waters.

Saint Ambrose. See **Ambrose, (Saint).**

Saint Hildegard, Abbess of Bingen. See **Hildegarde de Pinguia.**

Saint Laurent, Joannon de. Description abrégée du fameux cabinet de M. le Chevalier de Baillou, pour servir à l'histoire naturelle des pierres précieuses, métaux, minéraux et autres fossiles. Luques, 1746. 156 p. 8°. Pre-Linn. 1746.1

Chap. 14, p. 93. Pétrifications. Les pétrifications des poissons, p. 93-96. (Anguille, Carcharias, brochets, dorades, sardines, turbots et tanches.)

Salenius, Jo. G. (respond.) Dissertatio de iure venationis et aucupii. Upsaliæ, 1663. 4°. Pre-Linn. 1663.1

D. Dan. Lipstorp, præses.

Salerne, François & Arnault de Nobleville, L. D. See **Arnault de Nobleville & Salerne.**

Sallengre, Henr. de. Antiquitatum Romanarum thesaurus novus. Hagæ Comitum, 1724. fig. Pre-Linn. 1724.1

"Tom. I. continet librum de piscibus."

Salmon, Thomas [1679-1767] Die heutige Historie der Sundaischen Inseln als Borneo, Java und Sumatra. Halle or Altona, 1733. pls. 4°. Pre-Linn. 1733.1

A few fishes named, but not described.

Saluste, Guillaume de (Seigneur du Bartas). See **Du Bartas, Guillaume de Saluste (Seigneur).**

Salviani, Hyppolyto [1514-1572]. For a biographical memoir, see **Bushman, J. S.** in **Jardine's Naturalist's Library**, London, 1845-46, vol. XXXV.

— *Aquatilium animalium historiæ liber primus, cum eorundum formis aere excusis.* Romæ, 1554-1558. 16, 256 leaves. 88 pls. portrait. Pre-Linn. 1554.1

92 Italian fishes are figured and described. There is also a table in which each fish is identified with that named by Aristotle, Oppian, Pliny, Athenæus, Aelian, and other authors; volume and page of these writers being cited. The Latin, Greek, and common names of each fish are also given.

Salviani, H.

This finely printed work, the plates of which in accuracy and beauty far surpass any figures published in the next 100 years, seems to have been issued in parts. The copy belonging to the A. M. N. H. bears date of 1554 on the title-page, and 1558 on the last page. A continuation of this work was promised, but not brought out.

Great difficulty is experienced in working out the editions of Salviani's book. The data is scant and contradictory. There are supposed editions of 1555 and 1557, which may be explained on the basis that the work was issued in parts as the fish were studied and the plates made. Engelmann (p. 442) definitely says that an edition was issued of 99 figs. on 82 leaves without text, in small folio and having the title of the 1554 edition. He also states that an Italian version was issued on March 20, 1559. The former of these is probably the next title (found in Boehmer, vol. II, pt. II, p. 52).

— *Icones piscium*. Romæ, 1593. fol. Pre-Linn. 1593.1

Equally isolated is the following title, quoted from Bauer.

— *Historia de piscibus*. Roma, 1593. figs. fol. Pre-Linn. 1593.2

Quite definitely established, however, are the following editions:

— *De aquatiliu animalium eorundem formis*. Venetiis, 1600. fol. Pre-Linn. 1600.1

Another folio ed., Venice, 1602.

Sannazaro, Jacopo [1458–1530] *Piscatoria, etc.* Romæ, 1526. 8°. Pre-Linn. 1526.1

Other eds. are: Naples, 1526; Venice, 1527 & 1528; Paris, 1527; Venice, 1533. Found also in:

— *Opera omnia Latine scripta*. Venetiis, 1526. 8°. Pre-Linn. 1526.2

The Opera passed through many eds.: 4 at Venice, 1526–1725; 8 at Leyden, 1536–1592; and 4 at various places, 1609–1728.

For present day versions of Sannazaro, see:

"La egloghe piscatorie di A. S. S. recate in versi Italiani dal Cavaliere L. Biondi." Torino, 1823. 8°.

"De ecloga piscatoria thesim proponebat A. Campaux." Paris, 1859. 8°.

"The piscatory eclogues of Jacopo Sannazaro" edited with introduction and notes, by Wilfred P. Mustard. Johns Hopkins Press, Baltimore, 1914. 94 p. 8°.

Saunders, James. The compleat fisherman. Being a large and particular account of all the several ways of fishing now practised in Europe, with curious secrets in the art of fishing as well in the sea, as in lakes, rivers, or brooks. More particularly calculated for the sport of angling. Also, an account of the principal rivers, lakes, &c. in England, and what kinds of fish are found in them. London, 1724. vi, 234 p. pl. 12°. Pre-Linn. 1724.1

Another ed., London, 1725, entitled "The compleat troller." A 3rd ed. appeared, 1778, and the last, 1800, was "The fisherman, or, the art of angling made easy."

Saurmann, Thomas (*respond.*)

Analysis exercitationes 225. J. C. Scaligeri ad Cardanum de piscium habitaculis et allelophagia, seu mutuâ Laniena. Inaug. Dissert. Wittebergæ, 1639. 4°. Pre-Linn. 1639.1

Martin Heins, *præses*.

Scaliger, Julius Caesar [1484–1558] For a brief sketch of the life and works of this very learned man who edited both Aristotle and Pliny with notes and comments, see R. C. Christie and John Edwin Sandys in *Encyclopædia Britannica*, 1911, Vol. XXIV, p. 283.

— *Exotericarum exercitationum liber xv. de subtilitate ad Hieronymum Cardanum*. Lutitiæ [Paris], 1557. 476 folios. Pre-Linn. 1557.1

Fishes in *Exercitationes*, nos. 201 & 225. Echineis as a shipholder.

This work passed through many editions: Basel, 1560; Leyden, 1615; Hanoviæ, 1634; & Frankfort, 9 editions, 1572–1672.

Scheffer, Henric Theophil [1710–1759] *Aanmärkningar öfver Nicol Seländer's svar, hurn en sådan lykta mä kunna redastil, at liuset kan deruti brinna om natte tid under vatnet in en siö, och säledes med skenet locka in fisken uti nägon behändig fiske-bradg?* K. Svensk. Vetensk. Acad. Handl., 1750, 67. Pre-Linn. 1750.1

— *Anmerkung über N. Seländer's Frage, wie eine Laterne zu zubereiten ist, dass in ihr das Licht bey Nacht unter dem Wasser in einem Teiche brennen und also mit seinem Scheine die Fische in ein Netz locken kann.* König. Schwed. Akad. Abhandl., 1750, 68. Pre-Linn. 1750.2

See note under Kästner, A. G., this section.

Scheffer, Johanes [1621–1679] *Laponia id est regionis Lapponum et gentis nova et verissima descriptio, etc.* Francofurti, 1673. xiv, 380 p. ill. 4°. Pre-Linn. 1673.1

Contains some account of Lapland fishes.

A 2nd ed., Frankfort, 1678. A German version appeared at Frankfort & Leipzig, 1675. Other foreign versions follow.

— *The history of Lapland*. Oxford, 1674. 147 p. fol. Pre-Linn. 1674.1

In another English ed., containing other works on Lapland, London, 1704.

— *Histoire de la Lapponei, etc.* Paris, 1678. ill. 4°. Pre-Linn. 1678.1

— *Waerachtige in aen-merkens-waerdige historie van Lapland, etc.* Amsterdam, 1682. Pre-Linn. 1682.1

Fishes, book II, p. 107-109; book III, p. 25-28, 72.

Scheffer, S. (*aus Görlitz*) (*respond.*) *Exercitium juridicum de jure venandi, aucupandi et piscandi.* Jenæ, 1638. 4°. Pre-Linn. 1638.1

Johann Fibig, *præses.*

Schelhammer, Günther Christopher [1649-1716] *Anatomes Xiphiae piscis, oceani incolæ, cultro anatomico MDCCIV in Academia Kilonensi subjecti brevis enarratio ad P. Hottonem: cui accedit Lumpi & Ophidii ejusdem generis breve examen.* Hamburgi, 1707. 24 p. pl. 4°. Pre-Linn. 1707.1

Abstract, *Nouv. Litt. Germ.*, Hamburg, 1708, p. 119.

This paper was broken up and the description of each fish published separately as:

— *Anatome Anglorum piscis (Cyclopteri lumpi).* *Ephemer. Acad. Nat. Cur.*, 1712, cent. 1 & 2, append., 126-128. Pre-Linn. 1712.1

— *Anatome Ophidii piscis.* *Ephemer. Acad. Nat. Cur.*, 1712, cent. 1 & 2, append., 128-129. Pre-Linn. 1712.2

— *Anatome Xiphiae piscis.* *Ephemer. Acad. Nat. Cur.*, 1712, cent. 1 & 2, append., 110-126. Pre-Linn. 1712.3

— *Descriptio anatomica Xiphiae piscis* (In Valentini, M. B. *Amphitheatrum Zootomicum*, 1720, pt. 2, 102-110. pl.) Pre-Linn. 1720.1

In this reprint, although the title says anatomy of Xiphias only, all 3 fishes are considered.

Scheuchzer, J.G. (*filius J. J.*) (*translator*) See Kaempfer, E. *The history of Japan, etc.* 1727.

Scheuchzer, Johann Jacob [1670-1733] A bibliography (1694-1721, — 47 p.) is found at the end of his "*Itinera per Helvetiæ alpinas regiones facto annis 1702-11.*" 4 vols. Leiden, 1723. 4°.

— *Physica oder Naturwissenschaft.* 2 vols. (in 1). Zurich, 1703. 300 & 300 p. 8°. Pre-Linn. 1703.1

Vol. II, *Von den Fischen*, p. 405-411.

Augmented eds.: Zurich, 1711, 1729, 1743. 1729 ed. seen by us. 110 fishes named & structures discussed, vol. II, chap. xxxvi.

— *Beschreibung der Naturgeschichte des Schweizerlandes.* 3 vols. Zurich, 1706-18. 4°. Pre-Linn. 1706.1

Fossil sharks' teeth, vol. II, p. 143.

— *Piscium querelæ et vindiciæ.* Tiguri, 1708. 36 p. 5 pls. 4°. Pre-Linn. 1708.1

For a critique of this work, see Roche, A., & Demontmerot, C. 1897.1.

— *Bildnissen verschiedener Fischen, und dero Theilen welche in der Sündfluth zu Grund gegangen.* Zurich, 1708. 8 p. 5 pls. 4°.

Pre-Linn. 1708.2

An abbreviated German version of the above, which is also found in his:

— *Epistola ad Bajerum.* *Acta Phys. Med.*, 1708, append., p. 92.

Pre-Linn. 1708.3

— *Herbarium diluvianum.* Zurich, 1709. fol. Pre-Linn. 1709.1

Some fossil fishes described. Augmented ed., Leyden, 1723, 119 p. 14 pls. — fossil fishes, p. 8-10, 22 (fig. 7, pl. v), 44 (fig. 6, pl. ix).

— *Bibliotheca scriptorum historiæ naturalis omnium terræ regionum inservientium. Historiæ naturalis Helvetiæ prodromus.* Tiguri, 1716. 8°. Pre-Linn. 1716.1

Another ed., augmented by J. Le Long by the inclusion of "scriptores historiæ naturalis Galliæ," Zurich, 1751. xiv, 241 p. 8°.

— *Museum diluvianum.* Tiguri, 1716. 107 p. 8°. Pre-Linn. 1716.2

Some fossil fishes described.

— *Meteorologia et oryctographia Helvetica.* Zürich, 1718. 336 p. pls. 4°. Pre-Linn. 1718.1

Fossil fishes, with figs., p. 333-336.

— *Biblia ex physicis illustrata quibus res naturales in Scriptura Sancta occurrentes exhibentur, figuris nitidis a J. A. Pfeffel sculptis.* 4 vols. Augustæ Vindelicorum, 1731-35. fol. Pre-Linn. 1731.1

This seems to be the original ed. Other eds. & versions are:

— *Physica sacra. Iconibus æneis illustrata, etc.* 4 vols. Augustæ Vindelicorum, 1731-35. 1536 p. 750 pls. Pre-Linn. 1731.2

— *Kupferbibel in welcher die Physica sacra oder geheiligte Naturwissenschaft derer in heiliger Schrift vorkommenden natürlichen Sachen, deutlich erklärt und bewährt, etc.* 4 vols. Augsburg & Ulm 1731-1735.

Pre-Linn. 1731.3

— *Physique sacrée, ou histoire naturelle de la Bible, traduite du Latin.* 8 vols. Amsterdam, 1732-1737. 750 pls. fol. Pre-Linn. 1732.1

Vol. I, p. 25, pl. 15 — The Creation (fifth day) — fishes: p. 68, pl. 53 — The results of the Deluge — fossil sharks' teeth; p. 68-70, pls. 54-57 — Fossil fishes.

Vol. III, p. 79-80, pls. 238-239 — Scaled fishes permitted to be eaten by the Jews — eel, lamprey and sole (Leviticus xi, 9-12).

Scheuchzer, J. G.

Vol. VI, p. 54-55, pl. 518 — Fishes of the sea — internal organs of the pike (Job xii, 8).

Vol. VII, p. 238-239 — Leviathan = a tunny (pl. 557) or a hammerhead shark (pl. 610) (Psalm lxxiv, 14): p. 462-466, pl. 650 — Jonah's great fish = a shark (Lamia).

Vol. VIII, p. 134-135, pl. 713 — The miraculous draught of fishes (Luke v, 4-7): p. 250-252, pl. 745 — The scorpion = Scorpæna.

Copy, N. Y. P.

— Geestelyke Natuurkunde. 15 deelen (in 8). Amsterdam, 1735. fol.

Pre-Linn. 1735.1

A later Dutch ed. is: "Bijbel der Natuur." Amsterdam, 1784. roy. 8°.

Schillinger, Franc. Kasp. Vier-jährige persianische und ostindische Reise, neben Beschreibungen vieler orientalischen Völker, mit Darstellung derer zahmen und wilden Thiere in Indien, wie auch Vögeln, Fischen, Früchten, Erd und Seegewächsen.

Nürnberg, 1707. 8°. Pre-Linn. 1707.1

Another ed., Nürnberg, 1716.

Schnurr, Balthasar. Kunst- Haus- und Wunderbuch, darinnen allerhand . . . Fischen . . . gehandelt wird . . .

Auffs new verbessert, vermehrt und mit einem nützlichen Register gezieret. Nürnberg, 1654. 8°. Pre-Linn. 1654.1

Another ed., Frankfurt, 1664, 1878 p.

Schonevelde, Stephanus A. Ichthyologia et nomenclaturæ animalium marinarum, fluviatiliū, lacustrium, quæ in florentissimis ducatibus Slesvici et Holsatiæ et Emporio Hamburgo occurrunt triviales; ac plerorumque hactenus desideratorum imagines, breves descriptiones et explicationes. Hamburgi, 1624. 85 p. 7 pls. 4°.

Pre-Linn. 1624.1

Contains a list of fishes in alphabetical order in both Latin and Teutonic. Anatomy given of herring, catfish and dogfish.

Schoock, Martin (*præses*) [1614-1669] Dissertatio de harengis, vulgo holecibus dictis. Groningiae, 1649. 8°.

Pre-Linn. 1649.1

Ant. Mattheus, *respond.*

Schott, Gaspar [1606-1666] For critical notes on the work listed below, see St. Leger, Abbé de, "Notice raisonnée des ouvrages de Gaspar Schott, Jésuite: contenant des observations curieuses sur . . . l'histoire naturelle et les arts." Paris, 1785. 103 p. 8°.

— Physica curiosa, sive mirabilia naturæ et artis libris xii comprehensa, quibus pleraquæ quæ angelis dæmonibus, hominibus, spectris, energumenis,

monstris, portentis, animalibus, meteoris, etc. 2 vols. Herbipoli, 1662. 1583 p. 57 figs. Pre-Linn. 1662.1

De mirabilibus animalium aquatiliū, vol. II, lib. x, p. 1256-1385. Echeneis as a ship-holder.

The 1st ed.; others, Herbipoli, 1667 & 1697.

Schrassert, Joh. Hardervicum antiquum ofte beschryvinge der stad Harderwijck. Harderwyck, 1732. 2 parts. 4°.

Pre-Linn. 1732.1

Contains data about fishing in Zuiderzee.

Schroeder, Johann [1600-1664] Zoologica, or the history of animals as they are useful in physick and chirurgery . . . Translated by T. Bateson. London, 1659. vi, 159 p. 8°.

Pre-Linn. 1659.1

Fishes used in medicine, p. 111-133. Copy, H.

— The compleat chymical dispensatory, in five books: treating of all sorts of metals, precious stones, and minerals, of all vegetables and animals . . . &c. Englished by W. Rowland. London, 1669. iii, 445 p. fol.

Pre-Linn. 1669.1

Not seen. Presumably an enlarged issue of the above.

Schwalbe, —. Lactes et ova simul in uno carpine. Comm. Litt. Norimbergæ, 1734, p. 305.

Pre-Linn. 1734.1

Schwenckfeld, Caspar [1563-1609] Theriotropheum Silesiæ in quo animalium, hoc est, quadrupedum, reptilium, avium, piscium, insectorum, natura, vis et usus sex libris perstringuntur: concinnatum et elaboratum, etc. Lignicii [Lignitz], 1603. xxiv, 568 p. 4°.

Pre-Linn. 1603.1

40 Silesian fishes are described.

Second ed., Lignicii, 1604.

Scilla, Agostino [1639-1700] For a biography, see Seguenza, G. "Agostino Scilla." Messina, 1868.

— La vana speculazione disingannata dal senso. Lettera risponsiva circa i corpi marini, che petrificati si trouano in varij luoghi terrestri, etc. Napoli, 1670. 168 p. 28 pls. 4°.

Pre-Linn. 1670.1

Reviewed anonymously in Phil. Trans. Roy. Soc., 1698, 19, 181-201.

— De corporibus marinis lapidescentibus quæ defossa reperiuntur, auctore Augustino Scilla, addita dissertatione Fabii Columnæ de glossopetris. Romæ, 1747. 73 p. 28 pls. frontisp.

Pre-Linn. 1747.1

Lapides bufonites (teeth of *Sargus*) and **glossopetras** (teeth of sharks) described with elegant copper-plate figures.

The first Latin version of Scilla. Others: Rome, 1752 (copy, A. M. N. H.) & 1759.

Scribonius, G. A. *Rerum naturalium doctrina methodica*. Basilia, 1587. 8°. Pre-Linn. 1587.1

Fishes of Switzerland considered.

Seba, Albert [1665–1736] *Locupletissimi rerum naturalium thesauri accurata descriptio et iconibus artificiosissimis expressio, per universam physicis historiam . . . Ex toto terrarum orbe collegit, digessit, descripsit, et depingendum curavit Albertus Seba*. 4 vols. Amstelædami, 1734–1765. 449 pls. gr. fol. Pre-Linn. 1734.1

Half title reads: "Description exacte des principales curiositez naturelles du magnifique cabinet d'Albert Seba." Text in Latin and French.

Vol. I, 1734: *Rana piscatrix* — *Pterophryne* & *Malthe*, p. 118–119, pl. 74; fish stages in frog evolution, p. 125, pl. 78. Vol. III, 1758; fishes, p. 58–109, pls. 23–34.

Seelen, Erich Gottlieb von. (*respond.*) *Dissertatio specimen pharmacologiæ sacræ de antimonio, cicuta et pisce Tobiaë sive siluro*. Gryphiswaldæ, 1708, 34 p. 4°. Pre-Linn. 1708.1

Christ. Helvig, *præses*.

Seger, George [—1678] *De piscium auditu*. *Ephemer. Acad. Nat. Cur.*, 1673–74 (1688), dec. 1, ann. 4 & 5, 142–143. Pre-Linn. 1688.1

Seger, Jo. Lud. *Landwirthschaftliche Teich- und Weyherluft, oder gründliche Information zur edlen Fischerey*. Francofurti, 1727. 8°. Pre-Linn. 1727.1

Seguyn, Pet., & Chasler, Hug. *Ergo piscium usus vere salubris*. Paris, 1628. Pre-Linn. 1628.1

Not seen. Title from Boehmer.

Selanders, Nicolas. *Responsio super quæstionem: quomodo talis lucerna parari posset in qua nocturno tempore lux sub aqua fluminis vel stagni servetur eaque pisces ad commodum receptaculum alliciantur?* *Comm. Litt. Norimbergæ*, 1744. Pre-Linn. 1744.1

Not seen; title from H. Cloquet.

Selincourt, Jaques Epée de. *L'art de toute sorte de chasse et de pêche, avec celui de guerir les chevaux, les chiens et les oiseaux*. 2 vols. Amsterdam, 1711. 12°. Pre-Linn. 1711.1

Other eds.: Lyons, 1719 & 1722. Probably a reprint of Louis Liger. (q. v.)

Semeyns, Meynert. *Een corte beschryvinge over de haringvisscherij*. Camerling, 1639. 8°. Pre-Linn. 1639.1
3rd ed. Others not known.

Sennert, Daniel [1572–1637] *Physica hypomnemata*. Lugduni, 1637. 471 p. Pre-Linn. 1637.1

Fossil fishes, p. 427. Copy, Col.

Serres, Olivier de (Seigneur du Prade) [1539–1619] *Le théâtre d'agriculture et mesnage des champs*. Paris, 1600. fol. Pre-Linn. 1600.1

Livre v, chap. XIII, treats of "L'estang, le pescher, le vivier."

Numerous eds., at least 17 before 1675. Modern ed. Paris, 1802.

Severinus, Marcus Aurelius [1580 or 84–1656] *Zootomia democritea, id est anatome generalis totius animantium opificii, libris quinque distincta, quorum setiem sequens facias delineabit*. Noribergæ, 1645. 408 p. figs. 4°. Pre-Linn. 1645.1

Anatomy of herring, sardine and dog-fish, with figures of viscera.

Cuvier & Valenciennes say that this was the first general and philosophic treatise on comparative anatomy.

— *De piscibus in sicco viventibus commentarius in libellum Theophrasti Eresi; naturæ & Aristotelis interpretis summi . . . De radio turturis (pastinacæ) marini (De radio trigonos marini)* Napoli, 1655. iv, 70 p. fol. Pre-Linn. 1655.1

— *Antiperipatias, hoc est, adversus Aristoteleos de respiratione piscium diatriba*. Napoli, 1659. xx, 128 p. fol. Pre-Linn. 1659.1

Fishes respire air by gills but also possess an air breathing organ (air-bladder).

Other eds., according to Agassiz: Amsterdam & Naples, 1661; & Naples, 1665. The former of these, issued at Amsterdam, in A. M. N. H.

The two preceding numbers are bound in one volume and are in catalogues listed under the title "Antiperipatias," etc. For the discrepancies in dates, see the following note from the catalogue of the British Museum (Natural History) (vol. IV, 1906).

"The date to the dedication and imprimatur is 1659; that on the title-page to the part 'De Piscibus' is 1655 and to its dedication 1646; whilst the preface to 'Phoca illustratus' is dated 1645, and its peroratio 1646. The 'De radio turturis marinæ,' the running title of which reads 'De radio trigonos marini,' is dated 1644."

— *Anatome arengæ atque sardæ* (In Valentini, M. B. *Amphitheatrum Zootomicum*, 1720, pt. 2, 133.)

Pre-Linn. 1720.1

Sibbald, (Sir) Robert [1641–1722] For memoir, see Jardine, (Sir) William (In his *Naturalists' Library*, 1841, vol. XX; also 2nd issue, 1845–46, vol. I).

Sibbald, R.

— *Scotia illustrata sive prodromus historia naturalis*. Edinburgh, 1684. 382 p. fol. Pre-Linn. 1684.1

In parts paged separately.

"Pars secunda specialis. Tomus secundus, De animalibus Scotiæ — De piscibus," p. 22-26. pls. (7 fishes figured.)

2nd ed., Edinburgh, 1696.

— The history ancient and modern of the sheriffdoms of Fife and Kinross, with the description of both, and of the firths of Forth and Tay, and the islands in them; with an account of the natural products of the land and waters. Edinburgh, 1710. fol. Pre-Linn. 1710.1

Fishes, p. 118-129.

1st ed. Reprinted, 1803 — an exact copy. Copy, N. Y. P.

— A advertisement anent the Xiphias or swordfish exposed at Edinburgh. [n. p., n. d.]

Sidren, J. *De materia medica e regno animali dissertatio*. Upsala, 1750. 24 p. Pre-Linn. 1750.1

Fishes, p. 293-295.

As a separate. Another issue in Linnæus, C. *Amœnitates Academicæ*, 1751, 2, no. 28; also in other eds. of this latter, 1762, & 1787. Copy, H.

Siegesbeck, Johannes Georg [1686-1755] *Anmerckung über die denen Annalibus Medico Physicis Part. xvi, p. 635, inserirte Relation von dem Fische Carcharias, und zugleich über die beygefügte Meinung derer Gelehrten: Das der Prophet Jonas von keinem Wallfisch, sondern vielmehr von einem solchen Raubfische Carcharias verschlungen worden*. Samml. Nat. u. Med. Kunst. u. Litt.-Gesch. Breslau, 1725, sect. 31, 67. Pre-Linn. 1725.1

Silos, Guiseppe. *Lettera al Sig. Pier Carlo Benvenuti sopra la pesca del pesce Spada*. (In *Scelte delle lettere memorabili, raccolto dall' ab Michele Giustiniani*. Napoli, 1683. p. 153.) Pre-Linn. 1683.1

Simson, Archibald [c. 1564-1628] *Hieroglyphica animalium, terrestrium, volatiliū, natatiliū, reptiliū, insectorum, vegetivorum, metallorum, lapidum, etc., quæ in Scripturis Sacris inveniuntur et plurimorum aliorum, cum eorum interpretationibus*. Edinburgi, 1622. 218 p. 4°. Pre-Linn. 1622.1

Lib. III. De natatilibus. 19 p.

2nd ed., Edinburgh, 1692.

Sincerus, Alexander. *Der in allerlei ergötzlichkeiten vergnügte Landmann darinnen allerhand zum Vögel-*

fang, Schiessen, Jagen und Fischerei dientliche Künste enthalten sind. Nürnberg, 1720. 12°. Pre-Linn. 1720.1

2nd ed. Nürnberg, 1734.

Sloane, (Sir) Hans [1660-1753] *For memoirs, see Jardine, (Sir) W. in Naturalist's Library*, 1836, vol. XIII; or *Ibid.*, 1845-46, vol. XXIII. Also Jaeger, B. (In his *Life of North American Insects, etc.* 1854.) Short sketches are in: *Mém. Acad. Sci. Paris*, 1758; *Bibl. Sci.*, 10, pt. II, 280; *Leips. Gel. Zeitg.*, 1753, 233; *Tübing. Bericht.*, 1753, 10. St; *Erlang. Gel. Beytr.*, 1753, 237.

— An account of the tongue of a *Pastinaca marina*, [Aëtobatis] frequent in the seas about Jamaica and lately dug up in Maryland and England. *Phil. Trans. Roy. Soc.*, 1697, 19, 674-676. Pre-Linn. 1697.1

— A voyage to the islands Madera, Barbados, Nieves, S. Christophers and Jamaica, with the natural history of the herbs and trees, four-footed beasts, fishes, birds, insects, reptiles, &c., of the last of those islands, . . . Illustrated with the figures of the things describ'd which have not been heretofore engraved. 2 vols. London, 1707-25. cliv, 264, 156; xviii, 499 p. 270 pls. Pre-Linn. 1707.1

Sloane's work and plates were constantly cited by writers of the 18th century, as Catesby, Edwards, Brisson, Linnæus, etc. and are often referred to still.

Agassiz notes a German version by Bernstiel, Berlin, 1764. Engelmann, however, shows this to be a translation of an English description of Sloane's collections.

— *Observations sur la castration des poissons pour les engraisser*. *Mém. Acad. Sci. Paris*, 1742 (1745), hist., 31-32. Pre-Linn. 1745.1

Extract from a letter from Sloane to Geoffroy, giving an account of experiments performed by Samuel Tull. See in this connection, Watson, W. 1754.1, this section.

"Sir Hans Sloane died in 1753, 93 years of age, leaving his library of fifty thousand volumes, a cabinet of two hundred volumes of dried plants, and an immense collection of other objects in natural history, chiefly accumulated by himself, to be offered to the nation for twenty thousand pounds. This purchase being made by the Government, originated the British Museum."

Smallegange, M. *Nieuwe cronyk van Zeeland. Eerste (éénig) deel. Vervattende de voor dezen uitgegeven cronyken van de Heeren Jacobus Eyn-dius, en Johan Reygersberg. . . etc.* Middelburg, 1696. fol. Pre-Linn. 1696.1

Contains data about fishes and fisheries, pp 178-192.

Smith, Charles [c. 1713–1762] *Antient and present state of the county of Down . . . with the natural civil history of the same, etc.* Dublin, 1744. 8°. Pre-Linn. 1744.1

Fishes, p. 235–241. The herring fishery, p. 241–250.

— *Ancient and present state of the county of Waterford, being a natural . . . and topographical description thereof, etc.* Dublin, 1746. 8°. Pre-Linn. 1746.1

"Of the fish and fisheries on the coasts of this county, and of the Nymph-Bank," p. 259–279. 2nd ed., Dublin, 1774.

— *Ancient and present state of Cork.* 2 vols. Dublin, 1750. 4 pls. 8°. Pre-Linn. 1750.1

Vol. II, book iv, chap. 5, "Of the fish and fisheries on the coasts of this county," p. 299–319.

— *Natural and civil history of the county of Kerry.* Dublin, 1756. 8°. Pre-Linn. 1756.1

Contains a chapter on the fish and fisheries of this county.

Smith, George. *The angler's magazine; or necessary and delightful storehouse; wherein everything proper to be known relating to his art is digested in such a method as to assist his knowledge and practice upon bare inspection; being the compleatest manual ever published upon the subject; largely treating on all things relating to fish and fishing, etc.* London, 1754. 12°. Pre-Linn. 1754.1

Published anonymously but known to be by this author.

Text in the form of a dictionary.

Enlarged ed., London, 1760. Followed by "The laboratory: or school of arts," etc. London, 7 eds., 1799–1810. See Smith, G. 1799.1.

Smith, John. *Profit and pleasure united, or the husbandman's magazine . . . To which is added the art of angling . . . etc.* London, 1684. iv, 120 p. ills. 12°. Pre-Linn. 1684.1

Another ed., London, 1704. 167 p.

This author is believed to have been the J. S. under whom certain titles are listed in this section. See note under S., J., and also in Westwood & Satchell.

Smith, (Capt.) John [1580–1631] *For a memoir, see Simms, W. G. "The life of Captain John Smith, founder of Virginia."* New York, 1846.

— *A map of Virginia; with a description of the countrey, the commodities, people, government and religion.* Oxford, 1612. Pre-Linn. 1612.1

List of fish found in Chesapeake Bay.

Smith wounded by a stingray.

This work, generally known as "The Description of Virginia," has been reproduced in Tyler, L. G. (editor) "Narratives of early Virginia, 1606–1620." New York, 1907.

— *A description of New England: or, the observations & discoveries of Captain John Smith (Admirall of that country) in the North of America, in the year of our Lord 1614 . . . etc.* London, 1616. Pre-Linn. 1616.1

Fishing and food-fishes.

Reprinted in Force's Historical Tracts, 2, tract 1. Extracts in Rept. U. S. Fish Comm. 1871–72 (1873) 152–153. Turned into Latin as:

— *Vera . . . descriptio navigationis in Novam Angliam . . . sub Capiteano J. Schmidt (In De Bry. Voyages [America, pt. x. Latin], 1619).*

Pre-Linn. 1619.1

— *New England's trials. Declaring . . . the benefit of that country by sea and land, etc.* Second ed. London, 1622. Pre-Linn. 1622.1

The abundance of food-fishes.

Reprinted in Force's Historical Tracts, 2, tract 2. Extracts in Rept. U. S. Fish Comm. 1871–72 (1873), 153–154.

— *The generall historie of Virginia, New England, and the Summer Isles: with . . . the maps and descriptions of all those countreyes, their commodities, people, government, customes, and religion yet knowne. Divided into sixe bookes.* London, 1624. fol.

Pre-Linn. 1624.1

Reissued with changed title page, 1626, 1627, 1632. Also found in Pinkerton's *Voyages*, 1812, vol. XIII; included in Arber's edition of Smith's complete "Works." London, 1884; and reprinted at Richmond, Virginia, 1890.

— *The description of Virginia by Captain John Smith enlarged out of his written notes. (In Purchas his Pilgrims, 1625, 4, lib. LX, cap. iii, p. 1691–1704.)*

Pre-Linn. 1625.1

Fishes, p. 1692–1695.

Taken from entry 1612.1.

— *Advertisements for the inexperienced planters of New England, or anywhere. Or, the pathway to experience to erect a plantation.* London, 1631. Pre-Linn. 1631.1

Sturgeon and cod-fishing.

Reprinted in Coll. Mass. Hist. Soc., 1833, 3, ser. 3. Extracts in Rept. U. S. Fish Comm. 1871–72 (1873). 151.

In addition to the reprints noted in footnotes to each title, two complete modern versions of Smith's works are:

The adventures and discourses of Captain John Smith, sometime president of Virginia and admiral of New England. Newly ordered by John Ashton, London, 1883.

Smith, J.

Travels and works of Captain John Smith. President of Virginia and Admiral of New England, 1580-1631. Edited by Edward Arber, with a biographical and critical introduction by A. G. Bradley. 2 vols. Edinburgh, 1910. cxlvi, 984 p. ill.

Smith, William. A natural history of Nevis and the rest of the English Leeward Charibee Islands in America. Cambridge, 1745. 318 p.

Pre-Linn. 1745.1

Fishes (dolphin, shark, etc.), p. 3, 18, 182-206. Fishing with the "Dog-wood" bark, p. 3-4.

Solinus, Caius Julius [fl. 3rd. cent. A. D.] Polyhistor; de mirabilibus mundi. [Rome, c. 1475]. 8°.

Pre-Linn. 1475.1

This work, written about 325 A.D., is essentially an abridgment of portions of Pliny's "Natural History," arranged from the geographical point of view, and greatly enlarged. The compilation was revised in the 6th century, and then received the name of "Polyhistor." Six or seven species of fish are described.

Other 15th cent. eds. are: Venice, 1473, 1491, 1493, 1498; Parma, 1480; Brescia, 1498; Bologna, 1500.

Copies 1st ed., H., H. E. H.; of other eds., N. Y. P., L. C., & H. E. H.

Title Brescia ed. reads:

—Collectanea de mirabilibus mundi. Brixiae [Brescia], 1498. fol.

Pre-Linn. 1498.1

Some later eds. are: Poitiers, 1554; Antwerp, 1572; Gotha, 1665; Leipsic & Nuremberg, 1777. An English version is:

—The excellent and pleasant work of Julius Solinus. Polyhistor . . . Translated out of Latin into English by Arthur Golding, Gent. London, 1587. 4°. [Blk. letter]

Pre-Linn. 1587.1

This contains the life of Solinus by John Camertes.

A modern ed. of the works of Solinus is:

C. Julii Solini collectaneo rerum memorabilium. Iterum recensuit Th. Mommsen. Berlin, 1895. cv, 276 p. 8°.

Soto, Hernando de [c. 1500-1542] See **Fidalgo de Elvas**.

Spada, Giovanni Giacomo [1680-1774] Dissertazione ove si prova, che li petrificati corpi marini, che nei monti adiacenti a Verona si trovano, non sono scherzi di natura, nè diluviani; ma antidiluviani. Verona, 1737. 23 p. 4°.

Pre-Linn. 1737.1

—Giunta alle dissertazione de' corpi marini petrificati; acced. diss. de plantis veronensibus. Verona, 1737. 18 p. 4°.

Pre-Linn. 1737.2

—Catalogus lapidum Veronensium, IDIOMORPHON, id est propria forma præditorum, qui apud Joannem Jacobum Spadam, etc. asservantur. Veronæ, 1739. 31 p. gr. 4.

Pre-Linn. 1739.1

—Catalogi lapidum Veronensium mantissa. Veronæ, 1740.

Pre-Linn. 1740.1

—Corporum lapidefactorum agri Veronensis catalogus quæ apud J. J. Spadam . . . asservantur. Editio altera . . . cui accedunt annotationes, etc. Veronæ, 1744. 81 p. illust. 4°.

Pre-Linn. 1744.1

All Spada's works contain references to Eocene fishes of Monte Bolca.

Spener, Christ. Maximilian. Catalogus zahlreicher, nützlicher und sonderbahrer von Natur und Kunst gebildeter Seltenheiten in Regno Animal, rahrer Preparatorum und in Spiritu Vini conservatorum von . . . Fischen, . . . auch andern Indianischen und Europæischen . . . See-Thieren . . . Petrificata antediluviana, verschiedene Thiere, Fischen, Muscheln, &c. Berlin, 1718. figs. 8°. Pre-Linn. 1718.1

Sperling, Jo. [c. 1603-1658] (*præses*) Dissertatio de respiratione piscium. Wittebergæ, 1637. 2 pl. 4°.

Pre-Linn. 1637.1

Eccard, *respond.*

—Exercitationes physicae. Wittebergæ, 1663.

Pre-Linn. 1663.1

Creation and generation of fishes, p. 684-686. Copy, Col.

Stade, Hans [1520-1565] Wahrhaftig Historie und Beschreibung einer Landschaft der wilden, nacketen, grimigen Menschenfresserleuten, in der neuen welt Amerika gelegen. Marburg, 1557.

Pre-Linn. 1557.1

For a list of the 21 subsequent editions and translations of this work, see introduction to the Portuguese version by A. Löfgren published by Instituto Historico e Geographico de São Paulo, Brazil, in 1900. Among the facsimile illustrations is a fishing scene in chapter 7, p. 128.

For English readers this book is best available as:

The captivity of H. Stade . . . in A. D. 1547-1555, among the wild tribes of eastern Brazil, etc. (In Hakluyt Soc., Works, 1874, no. 51.)

Staentzl de Cronfels, A. L. Piscinarium, oder Teicht Ordnung warinnen von Erbauung der Teichte, derselben Tämme, Röhren Ablass . . . von Erziehung und Versetzung der

Fisch . . . gehandelt wird. Ollmütz, 1680. 182 p. 8°. Pre-Linn. 1680.1

Starcke, J. Henri. De pisce hermaphrodito. Ephemer. Acad. Nat. Cur., 1699 (1700), dec. 3., ann. 7 & 8, 109. Pre-Linn. 1700.1

Steele, (Sir) Richard [1672–1729], & **Gillmore, Joseph.** An account of the fish pool. Consisting of a description of the vessel so-call'd, lately invented and built for the importation of fish alive and in good health, from parts however distant . . . London, 1718. 60 p. pls. 12°. Pre-Linn. 1718.1

At London, 1790, was issued "The town talk, the fish pool," etc. by Sir Richard Steele, — evidently a reprint of the above. The account of "The fish pool," p. 187–236.

Steensen, Niels. See **Steno, Nicolaus.**

Stegmann, Ambrose. De lue pennatorum et piscium morbis. Miscell. Acad. Nat. Cur., 1697 (1698), dec. 3, ann. 5 & 6, 385–386. Pre-Linn. 1698.1

Steinbock, Ernst Friedrich von. Unterricht von der Nutzbarkeit der Fische. Nürnberg, 1710. 8°. Pre-Linn. 1710.1

— Die noch nie genug gepriesene Kunst der edlen und hochschätzbaren Fischerey, samt allen deren Nothwendigkeiten; erstlich, in Erwählung und Bestellung derer dazu gehörigen Wasser, die Teiche zu bauen und anzulegen; ferner wie und wann die Fische zu besetzen, . . . und zu fangen, etc. Nürnberg, 1730. xiv, 374, xxvi p. pls. 8°. Pre-Linn. 1730.1

— Die noch nie genug gepriesene Kunst der Fischerei, nebst Beschreibung der Fische. Nürnberg, 1750. pls. 8°. Pre-Linn. 1750.1

Steller, George William [1709–1746] A sketch of Steller's life may be found in his "Beschreibung von dem Lande Kamtschatka," etc. Frankfort & Leipzig, 1774. (Steller, G. W. 1774.1.)

— Observationes generales universam historiam piscium concernentes: de generatione piscium; de aetate truttacei generis; de usu appendicum intestinalium, etc. Novi Comment. Acad. Petropol., 1753, 3, 405–420.

Pre-Linn. 1753.1

Other works by Steller in vol. II, p. 494.

Steno, or more properly Stenonis, Nicolaus [1638–1686] For a short

biography and list of writings, see Winter, J. G. 1916.1. For fuller biographies, see Plenkens, W. "Der Däne Niels Stensen, ein Lebensbild nach den Zeugnissen der Mit- und Nachwelt entworfen." Freiburg i. Br., 1884. Also Wichfeld, J. "Erindringer on den danske videnskabsmand Niels Stensen." Historisk Tidsskrift, Kjøbenhavn, 1865, 3. række, 4. bind, 1–109. For a list of other biographies, see Winter, p. 202–203. For full details as to editions and reprints, see "Opera," 1910 ed. listed below.

— De anatome rajæ epistola (In his De musculis et glandulis observationem specimen cum epistolis duabus anatomicis. Copenhagen, 1664. 4°.) Pre-Linn. 1664.1

This was in the form of a letter to Willem Piso. It also appeared in:

— De musculis & glandulis observationum specimen cum duabus epistolis, quarum una ad Guil. Pisonem de anatome Rajæ; & alteram ad Paulum Barbette de vitelli in intestinis pulli transitu. Amstelædami, 1664. 12°. Pre-Linn. 1664.2

Other eds.: Florence, 1667, & Lugduni, 1683. These essays were reviewed in Phil. Trans. Roy. Soc. 1666, 1, 176–178.

In this dissection, Steno discovered the spiral valve in the intestine and briefly described it, thus antedating the descriptions in Perrault, C., & in Anon. 743 & 769, this section.

— Elementorum myologiæ specimen, seu musculi descriptio geometrica cui accedunt *Canis carchariæ* dissectum caput, et dissectus piscis ex Canum genere. Florentiniæ, 1667. 4°. Pre-Linn. 1667.1

Another issue, Amsterdam, 1669. This work also was reviewed in Phil. Trans. Roy. Soc., 1667, 2, 627–628.

— De solido intra solidum naturaliter contento dissertationis prodromis. Florentiæ, 1669. Pre-Linn. 1669.1

Contains various references to glossopetras, — fossil teeth of sharks and rays.

— The prodromus to a dissertation concerning solids naturally contained within solids. London, 1671. xv, 112 p. pl. 8°. Pre-Linn. 1671.1

— [Anatome *Cyprinis brevis*] Acta Med. Phil. Hafnien., 1673, 1, 315–316. Pre-Linn. 1673.1

Figures (with an explanation) of a dissection made by Steno.

— Ova viviparorum spectantes observationes. Acta Med. Phil. Hafnien., 1675, 219–232. Pre-Linn. 1675.1

Steno, M.

Galeus laevis (figure and description of spiral valve and oviduct), *Spina piscis* (figure spiral valve), *Torpedo*, & *Argentine*.

Also found in Le Clercq & Manget, "Bibliotheca Anatomica," I, 1685, and in "Coll. Acad. Part. Etrang.," Paris, 1757, 4, 282-292.

— De dentibus canis marini. *Zodiacus Medico-Gallicus*, 1682, 4, 92.

Pre-Linn. 1682.1

This title, from Boehmer, seems to be a fragment of 1667.1.

— Extrait de la dissertation de N. Sténon sur les corps solides qui se trouvent contenus naturellement dans d'autres corps solides. *Coll. Académique*, (part. étrang.), 1757, 4.

Pre-Linn. 1757.1

A modern critical edition of the "Dissertation" is listed above under Winter, J. G. The complete scientific works of Steno with a brief biography have been issued by Vilhelm Maar under the title "Opera philosophica." 2 vols. Copenhagen, 1910. Copy, Col.

Stensen, Nils. See **Steno, N.**, the Latinized form of the name of the Danish physician.

Stephanus, Carolus. See **Estienne, Charles.**

Stobæus, Johannes. *Dissertatio historica de cerauniis, betulisque lapidibus sub præsidio Kilæ Stobæi.* Londini Gothorum, [Lund] 1738. pls. 4°. Pre-Linn. 1738.1

Glossopetras, p. 9-10.

Stobæus, (or Stobée) Kilian [1690-1742] *Opuscula in quibus petrefactorum, numismatum et antiquitatum historia illustratur, in unum volumen collecta.* Dantisci, 1752-53. 327 p. 17 pls. 4°. Pre-Linn. 1752.1

Contains *inter alia* J. Stobæus's "Dissertatio."

Stolze, — (respond.) *Dissertatio de ichthyocolla.* Helmst., 1756. 28 p. 4°. Pre-Linn. 1756.1

Phil. Conr. Fabricius, *præses*.

Strabo [c. 63 B. C.—] *Geographia.* Venice, 1472. fol. Pre-Linn. 1472.1

1st ed. not known to us. There is a reputed ed., Rome, 1469. Other early eds.: Treviso, 1480; Venice, 1494 (2 issues), 1502, 1516; Geneva, 1587; Paris, 1620. Copies of early eds.: Prin., L. C., H., Cor.

Among the best later eds. are those of Co-raes, Paris, 1805-19; Grosskurd, Berlin, 1831-34 (a monumental work); Kramer, Berlin, 1844-52; Müller, Paris, 1853; and Meineke, Leipzig, 1866-77. The first and best English version is that in 3 vols. by H. C. Hamilton, & W. Falconer, London, 1854-57 (reprinted 1889-1903). This contains a sketch of Strabo's life and critical notes on his work.

The following references apply to any ed.

Ichthyophagi: book II, chap. II, § 3; chap. V, § 33 & 36; book XV, chap. II, § 2 & 13; book XVI, chap. IV, § 4 & 13. *Fishes of the Nile*, book XVII, chap. I, § 40; chap. II, § 4 & 5.

Stradanus, Johannes [1536-1605] *Venationes ferarum, avium, piscium, pugnae bestiarum, depictae a Joanne Stradano; editae a Philippo Gallæo, carmine illustratae a C. Kiliano Dufflæo.* Antwerpiae, [1578]. 94 pls. obl. fol. Pre-Linn. 1578.1

"Many subsequent editions have appeared, the plates varying in number from 104 to 88. Some copies are entitled: "Venationis omne genus, aucupii piscatusque." — W. & S.

See also Visscher, C. J., this section.

Stradanus, Strada, or Straet was a Flemish-Italian painter who made the drawings reproduced herein.

Straet, Jan van der. See **Stradanus, Johannes.**

Suidas, — [*fl. late in 10th cent.* Concerning the man and his Lexicon see Daub, A. "De Suidas biographi-corum origine et fide," 1880; and "Studien zu den Biographika des Suidas," 1882; also in Sandys, J. E. "History of classical scholarship," 1906, p. 407.

— *Lexicon græcum.* Milan, 1499. fol. Pre-Linn. 1499.1

Editio princeps, translated by Demetrius Chalcondyles.

Copies: Y., N. Y. S., U. C., H. E. H. Another and enlarged ed. is:

— *Lexicon, Gr. et Lat. edidit, indices adjecit Lud. Kusterus.* 3 vols. Cantab. 1705. fol. Pre-Linn. 1705.1

Modern eds. are by T. Gaisford (1834), G. Bernhardt (1834-53), and most recent and valuable of all, by I. Bekker (1854).

Suidas, like Athenæus, wrote nothing on fishes himself, but has preserved to us data from other authors whose works are no longer extant and which but for him would be lost.

Sundius, Peter. *Surinamensia gril-liana.* Holmiæ, 1748. 34 p. pl. Pre-Linn. 1748.1

Gymnotus, p. 26.

Also in *Amœnitates Academicæ*, 1749, 1, 512; and in another ed., Erlangen, 1787. Copy, A. M. N. H.

Swammerdam, Jan [1637-1680] For life by H. Boerhaave, see in his edition of Swammerdam's "Biblia naturæ," Leyden, 1737, (Latin-Dutch); Leipsic, 1752 (German); and "Book of nature," London, 1758. For shorter sketches, see Locy, W. A. 1908.1 (p. 67-77, with portrait); and Miall, L. C. 1912.1 (p. 174-199).

— Catalogus musei, exhibens curiosam suppellectilem variarum rerum exotic. t. natur. q. artefact., quas 50 annorum spatio collegit. Amstel., 1679. 143 p. 8°. Pre-Linn. 1679.1

Glossopetras & bufonites, p. 9; pisces, p. 30-34.

A catalogue of his father's collection, in Latin and Dutch in parallel columns.

Copy, N. Y. P.

Szent-Iványi, Márton. Curiosa et selectiora variarum scientiarum miscellanea. Decades tres in partes totidem subdivisæ. 3 vols. Tyrnaviæ, 1689-91. 4°. Pre-Linn. 1689.1

Decadis III. Pars I, continet dissertationes X et quidem de . . . piscibus, etc.

— Dissertationes septem . . . IV. De piscibus. Tyrnaviæ, 1689. 2, 302 leaves. 4°. Pre-Linn. 1689.2

T

Tachard, Guy [—1694] Voyage de Siam des pères Jésuites envoyez par le roy au Indes & à la Chine. Paris, 1686. 424 p. Pre-Linn. 1686.1

Sharks, remoras, pilot-fish, bonitos and flying fish, p. 39–44.

Original ed. A Dutch version is:

— Reis van Siam . . . gedaan door de vaders Jesuiten. Utrecht, 1687. iv, 196, 79 leaves. 4°. Pre-Linn. 1687.1

Another Dutch ed. with almost identical title, Amsterdam, 1687.

— A relation of the voyage to Siam performed by six Jesuits sent by the French king to the Indies and China, in the year 1685. London, 1688. 298 p. Pre-Linn. 1688.1

Habits of sharks, remoras, and bonitos, 27–31. Fishes of the Cape of Good Hope, 66.

Reprinted in Arkstee & Merkus, Allg. Hist. Reisen, 1752, vol. XX.

Tappe, David [1649–] Fünfzehnen jährige curiose Ost-Indianische Reise-Beschreibung, so sich im Jahr Christi 1667 angefangen und im 1682 Jahre geendet hat. Hannover, 1704. 4°. Pre-Linn. 1704.1

Fishes, etc., 199–209.

Taverner, John. Certaine experiments concerning fish and fruite, practised by John Taverner, Gentleman, and by him published for the benefit of others. London, 1600. vi, 38 p. 4°. Pre-Linn. 1600.1

The experiments concern the construction of ponds, the treatment, breeding and feeding of fish therein, and the baits for and nature of pond fish.

Tavernier, Jean Baptiste [1605–1689] [On glue made by the Turks from body membranes of the sturgeon.] Phil. Trans. Roy. Soc. 1676, 11, 714. Pre-Linn. 1676.1

An extract from a running review in the Phil. Trans. of Tavernier's voyages.

Tempesta, Antonio [1555–1630] Nuova raccolta degli animali piu curiosi del mondo, disegnati et intagliati da Antonio Tempesta. Roma, 1600. 4°. Pre-Linn. 1600.1

Another ed., Rome, 1650.

— Venationes ferarum, avium, piscium, pugnæ bestiariorum; et mutuae bestiarum delineatae ab A. T. Romæ, 1602. obl. 4°. Pre-Linn. 1602.1

"Tempesta was a pupil of Stradanus, from whose work he seems to have borrowed the above title and the general idea of his compositions. They consist of 26 etchings in the edition of 1602 and 40 in that of 1627." — W. & S.

The edition of 1627 was printed by Visscher at Amsterdam and is generally listed under his name in bibliographies. See Visscher, C. J., this section.

Templer, John. [Method of catching carp in a pond with the hands.] Extract of a letter written by Mr. John Templer, June 16, 1673. Phil. Trans. Roy. Soc. 1673, 8, 6066–6067. Pre-Linn. 1673.1

Theocritus [*fl.* 3rd cent. B. C.] Idyllia, quæ extant, cum vet. scholiis, cura Jo. Fell. Oxoniæ, 1678. 8°. Pre-Linn. 1678.1

Idyll *xxi*, lines 9–12, enumerates the fishing implements of the Syracusan fishermen.

The Idylls of Theocritus have been many times translated, edited, and republished. The most complete early editions are those listed below.

— The idylliums of Theocritus, done into English . . . by Thomas Creech. London, 1681. 12°. Pre-Linn. 1681.1

Idyll *xxi*, "The fisherman," enumerates fishing implements used by two Syracusan fishermen; — "wicker baskets, rods, hooks, baits covered with seaweed, lines of horse hair, weels and wickerwork mazes, cords, and oars and an old boat on props."

Other English versions are: 1684, 1713, 1721, 1767, 1786, 1792, 1811. The best French translation is by Gail, Paris, 1808; the best German by J. H. Voss, Tübingen, 1808; & by Witter, Hildburghausen, 1819.

Theophrastus [*c.* 372–287 B. C.] For a sketch of his life, see Zeller, "Aristotle and the earlier peripatetics" (English translation by Costelloe & Muirhead, 1897). For a list of translations of his works into almost all European languages, see Baldwin's Dictionary of Philosophy and Psychology, vol. III, pt. i.

— De piscibus in sicco viventibus. Venetiis, 1479. fol. Pre-Linn. 1479.1

Other eds.: Venice, 1497–98 (in "Opera" of Aristotle edited by Manutius); Paris, 1529;

Basel, 1550, 1552; Naples, 1655 (In "Antiperipatias" by Severinus, q. v.). The following title from Haller seems unknown to other bibliographers:

— De piscibus, de singultu, de doloribus, de ebrietate, de sudore. 1495. Pre-Linn. 1495.1

Dissertation on ability of fishes to stand drought found also in "Opera," the first edition of which seems to be:

— Opera omnia: Graece. Basilæ, 1540. fol. Pre-Linn. 1540.1

Two other early eds.: Venice, 1552, and Lugduni Batavorum, 1613. Often reissued. The best eds. are those by J. G. Schneider, Leipsic, 1821 (Latin); and by F. Wimmer, Paris, 1866 (Greek and Latin in parallel columns).

Theophrastus, a native of Eresus in the island of Lesbos, was the friend and successor of Aristotle, the guardian of his children, and the inheritor of his library.

Thévet, F. André [1502–1590] Les singularitez de la France antarctique, autrement nommée Amérique, & de plusieurs terres & isles decouvertes de nostre temps: . . . Paris & Anvers, 1558. 163 p. ill. sm. 8°. Pre-Linn. 1558.1

Contains first printed figures of Brazilian fishes.

Italian and English translations are:

— Historia dell' India America, detta altramenta Francia antartica, tradotta . . . in Italiano da G. Horologgi. Venetia, 1561. 8°. Pre-Linn. 1561.1

— The new found worlde, or Antarctike, wherein is contained wonderful and strange things, as well as . . . fishes . . . written in the French tong . . . and new translated into Englishe . . . etc. London, 1568. 140 leaves. Pre-Linn. 1568.1

Copies of this English version and of the original edition are in J. C. Brown library.

Other eds. are: Paris, 1554 (doubtful); Venice, 1584 (Italian). A modern French ed. with notes by Paul Gaffarel, Paris, 1878.

— Histoire générale des Indes occidentales et terres neuves. Paris, 1584. 8°. Pre-Linn. 1584.1

Not seen. Possibly a version of the above. Another ed., 1587.

Thiemen, Johann Christoph. Haus-Feld-Arzney-Koch-Kunst- und Wunderbuch . . . in zwanzig Abtheilungen enthalten, darinn folgende Sachen abgehandelt werden . . . xv. Von der Fischerey. . . Nürnberg, 1682. pls. 4°. Pre-Linn. 1682.1

"The 15th division contains directions for making, filling and emptying fish ponds; for stocking them, removing carp, making reservoirs and renovating old ponds; shows how to take fish with nets, traps, angles, night lines and the hands; and treats of the qualities of vari-

ous fish as food and their uses in medicine, etc." — Westwood & Satchell, p. 208.

Another ed., Nuremberg, 1685, 1587 p. 4°.

Thilo, Gottfried (præses). Exercitatio de generatione piscium. Wittebergæ, 1667. 2 pls. 4°. Pre-Linn. 1667.1

Gottfried Balduin, respond.

Thomas, Gabriel [fl. 17th cent.] An historical and geographical account of Pennsylvania and West-New-Jersey. London, 1698. 8°. Pre-Linn. 1698.1

Gives a list of fishes found in the "Suskehanah" (Susquehanna) river.

— Continuatio der Beschreibung der Landschaft Pennsylvanien, etc., darin die seltsamen Creaturen, Thiere, Vögel und Fische enthalten sind. Frankfurt & Leipzig, 1702. ii, 40 p. 8°. Pre-Linn. 1702.1

Modern reprints are: New York, 1848; Cleveland, 1903; and in "Narratives of early Pennsylvania and west New Jersey and Delaware, 1630–1707," edited by Albert C. Myers. New York, 1912.

Thoresby, Ralph [1658–1725] Part of a letter from Mr. Ralph Thoresby, F.R.S. to the publisher, concerning several observables in his musæum, near Leeds in Yorkshire. Phil. Trans. Roy. Soc. 1704, 23, 1070–1072. pl. vii. Pre-Linn. 1704.1

Brief description with figure (Tab. 7, fig. 1) of "the outward skin of the maw of a fish" from the Indies, p. 1070.

Tiburtius, Tib. Warum das Karpfenlaich in einigen Teichen nicht aufkomme, und wie dem abzuhelpen. Hannöv. Samml., 1757, 641. Pre-Linn. 1757.1

Other works in vol. II.

Titius, J. D. (editor) [1729–1796] Seltenheiten der Natur und Oeconomie, nebst deren kurzen Beschreibungen aus den Danziger Erfahrungen und Nachrichten, u.s.w. See Hanow, Michel Christoph, 1753.1, this section.

Torrubia, P. Fr. Joseph [c.1590–1768] Aparato para la historia natural española. Tomo primero. Contiene muchas dissertaciones physicas, especialmente sobre el diluvio. Resuelve el gran problema de la transmigracion de cuerpos marinos y su petrificacion en los mas altos montes de España, donde recientemente se han descubierto, etc., Madrid, 1754. xxiv, 204 p. 14 pls. fol. Pre-Linn. 1754.1

Fossil fishes, p. 11. Glossopetras españoles, p. 37–39. figs. Subterranean fishes of Mexico, p. 100. Fishes and the deluge, p. 175, 192, and 198.

Tournefort, Joseph Pitton de [1656–1708] For biographical memoirs, see appendices to works cited below.

— Relation d'un voyage du Levant . . . contenant l'histoire . . . de plusieurs isles de l'Archipel, de Constantinople, des côtes de la Mer Noire, de l'Arménie, de la Georgie, des frontières de Perse & de l'Asie Mineure . . . Enrichie . . . de plusieurs observations touchant l'histoire naturelle. (To which is prefixed an) Eloge de M. de Tournefort. Par M. de Fontenelle) 2 vols. Paris, 1717. illust. 4°.

Pre-Linn. 1717.1

"Poissons en usage chez les Grecs les jours de jeûne; manière de pêcher en Naxie, en Provence, et au Trident."

Other eds. are: Amsterdam, 1717 (or 1718), 1737 (Dutch); Lyons, 1727; Nuremberg, 1776 (German). An English version is:

— A voyage into the Levant [translated by J. Ozell] . . . To which is prefixed the author's life [by H. M. Lauthier]; as also his eulogium, pronounced by M. Fontanelle, etc. 2 vols. London. 1718. ill. 4°.

Pre-Linn. 1718.1

Another English ed., 3 vols. London, 1741. 8°.

Tradescant, John (the younger) [1608–1662] Musæum Tradescantianum; or a collection of rarities, preserved at South-Lambeth near London by John Tradescant. London, 1656. sm. 8°.

Pre-Linn. 1656.1

"Divers sorts of strange fishes" (List of fishes from various countries), p. 8–9. Copy, H.

"The Tradescant was the first cabinet of natural curiosities formed in England. John Tradescant [senior], who is supposed to have died in 1638, bequeathed the collection to his son, who, in turn, left it to Elias Ashmole. These curiosities were therefore the nucleus of the Ashmolean Museum at Oxford." — Quarritch Cat. 1912.

Triewald, Märten [1691–1747] Rön huru iglar och fyrfotor kunna fördrifvas utur rude-dammar [Cyprinus]. K. Svensk. Vetensk. Acad. Handl., 1746, 216.

Pre-Linn. 1746.1

— Untersuchung wie Blut-Egeln und Eidechsen aus Karauschen-Teichen

[Cyprinus] zu vertreiben sind. König. Schwed. Akad. Abhandl., 1746, 221.

Pre-Linn. 1746.2

See note under Kästner, A. G., Pre-Linn.

Tristaon, Manuel A treatise of Brasil, written by a Portugal which had long lived there. (In Purchas his Pilgrims, 1625, vol. IV. lib. vii, cap. i, p. 1289–1320.)

Pre-Linn. 1625.1

Section 6. Of the fishes that swim in the salt water.

Trivigiano, Angelo (editor). Libretto de tutta la navigatione de Re de Spagna. De le isole et terreni novamente trovati. [Translated and edited by Angelo Trivigiano]. Venesia. per Albertino Vercelle da Lisona, 1504, 16 leaves. 4°.

Pre-Linn. 1504.1

This contains the first printed account of fishing with the remora. See also Martyr, 1504.1, this section.

Tull, Samuel. See **Watson, William**.

Turnebus, Adrianus [1512–1565] Plinii libri II de piscibus cum scholiis Joh. Cæsarii. Venetiæ, 1518. 4°.

Pre-Linn. 1518.1

Turner, — (Dr.) [Letter mentioning some fifty English fishes] (Prefixed to Book IV of Conrad Gesner's "Historia Animalium," Frankfort ed. 1620.)

Pre-Linn. 1620.1

Tyson, Edward [1650–1708] Embryonis Galei lævis anatome [in] Appendix ad historiam naturalem piscium. (In Willughby, F. De historia piscium. Oxonii, 1686. fol. ill.) p. 13–16.

Pre-Linn. 1686.1

— Lumpi Anglorum anatome [in] Appendix ad historiam naturalem piscium. (In Willughby, F. De historia piscium. Oxonii, 1686. fol. ill.) p. 25–27.

Pre-Linn. 1686.2

— Cuculus lævis cæruleo flavescens, cui in supremo capite branchiarum opercula. Or, the Yellow Gurnard [Callionymus lyra]. Phil. Trans. Roy. Soc. 1704 (1706), 24, 1749–1753. pl.

Pre-Linn. 1706.1

U

Uterverius, Joannes Cornelius. One of the group of the pupils of Ulisse Aldrovandi, to whom was confided by the

senate of Bologna the work of collecting and editing the scattered manuscripts of the master.

V

Valentijn, François [1666–1725] *Beschryving van oud- en nieuw Oost-Indien, vervattende een naauwkeurige en uitvoerige verhandeling van Nederlands mogentheyd in die gewesten, benevens eens wydluftige beschryvinge der Moluccos, Amboina, Banda, Timor en Solor, Java, en alle de Eylanden onder deselve landbestieringen behoorende; als ook der landdieren, vogelen, visschen, enz. enz. Met meer dan thein honderd en vyftig prentverbeeldingen verryckt.* 5 vols. (in 10 parts.) Dordrecht & Amsterdam, 1724–26. 1050 pls. fol. Pre-Linn. 1724.1

Vol. III: Descriptions and figures of 528 fishes of Amboina, p. 330–515; Japanese gold and silver fish, p. 510; Fishing at Amboina, p. 15; at Banda, pt. II, p. 31. Vol. V: Fish of Ceylon, pt. I, p. 54; Salmon in Japan, pt. II, p. 71.

A 2nd & modern ed., The Hague, 1856–58. 3 vols. 8°. An extract from the original work is:

— *Poissons extra-ordinaires d'Amboine.* (In Prévost, A. F. *Histoire générale de voyages*, etc. La Haye, 1747, 17, 84–254. 485 figs.) Pre-Linn. 1747.1

— *Descriptio Amboiensis.* III. *De piscibus Amboiensis*, etc.

This atlas of more than 50 plates of fishes, from the library of Albert C. L. Gunther, was presumably taken from the above work (1724–26).

This man, whose name is sometimes written Valentyn, was a Dutch Protestant missionary in Amboina. His book is the outcome of his travels and experiences in the East Indies, covering two periods, of nine and eight years each.

Valentini, Michael Bernhard [1657–1729] *De virgine in sceletto funduli conspicua.* Misc. Acad. Nat. Cur., 1697 — 1698 (1700), dec. 3, ann. 5 & 6, 96. Pre-Linn. 1700.1

— *Museum Museorum, oder vollständige Schau-Bühne aller Materialien und Specereyen, nebst deren natürlichen Beschreibung . . . aus andern Material- Kunst- und Naturalien- Kammern, Oost- und West-Indischen Reiss-Beschreibungen . . . verfasst und mit etlich hundert saubern Kupferstückern*

unter Augen geleet. 3 parts (in 1 vol.) Franckfurt-am-Mayn, 1704. xxii, 520; ii, 76; ii, 119 p. 16 pls. illust. fol. Pre-Linn. 1704.1

The half-title and the engraved title both read: "Valentini Natur- und Materialien-Kammer, auch Ost-Indianische Send-Schreiben und Rapporten."

Th. I, lapides bufonites and glossopetras, p. 63–66; fossil fish, p. 73–74. Th. III, sea horse, p. 469; fishes, p. 484–492: all figured and described.

2nd ed., Frankfort, 1714. The 3rd Theil (which contains the fishes), according to catalogue of British Museum (Natural History), was issued in separate and enlarged form in 1714 under the title listed below (1714.1).

— *Historia litteraria S. R. J. Academiae Naturæ Curiosorum . . . &c.* Gissæ, 1708. 4°. Pre-Linn. 1708.1

In nos. 36 & 37, *Anguilla* and *Glossopetras* are described.

— *Neu-aufgerichtetes Rüst- und Zeughaus der Natur . . . Dritten Theils des Musei Museorum*, etc. Franckfurt-am-Mayn, 1714. vi, 226, 209, 24 p. 40 pls. text figs. fol. Pre-Linn. 1714.1

— *Amphitheatrum zootomicum, tabulis ænis quam plurimis exhibens historiam animalium anatomicam*, etc. 2 parts. Frankfort & Gissæ, 1720. 262 p., appendix. 114 p. 105 pls. fol. Pre-Linn. 1720.1

This is merely a compilation of different anatomical memoirs, 18 of which are on fishes and are elsewhere listed under their authors. These are found in part II.

2nd ed. Frankfort, 1742. fol.

Valentyn, Francis. See **Valentijn, François.**

Valla, Georgius [1430–1499] *De natura partium animalium, lacte, bile, carnibus, piscibus*, etc. Argent., 1529. 8°. Pre-Linn. 1529.1

Vallisnieri, Antonio [1661–1730] For a sketch of his life, see *Bibliothèque Italique*, tome V, no. 3; also in *Opera*, 1733, below.

— *De ovario anguillarum.* *Ephemer. Acad. Nat. Cur.* 1712, cent. 1 & 2, 153–165. fig. Pre-Linn. 1712.1

Vallisnieri, A.

— *Descriptio anatomica anguillæ* (In Valentini, M. B. *Amphitheatrum Zootomicum*, 1720, pt. II, p. 126–131, pl.) Pre-Linn. 1720.1

— Osservazioni di corpi marini che su monti si trovano; della loro origine, e dello stato del mondo avanti 'l diluvio, nel diluvio, e dopo il diluvio, lettere critiche. Venezia, 1721. 254 p. figs. 4°. Pre-Linn. 1721.1

Latin edition: "De corporibus marinis," etc. Venice, 1728.

— Opere diverse. 3 vols. Venetia & Padua, 1721–26. 79 pls. 4°. Pre-Linn. 1721.2

Reproduction of eel, vol. II, p. 89.

— Del Cameleonte e di vari animali d'Italia, [de locustis, ranis, crocodilo, remora, etc.] Giorn. Letter. Italia, [c. 1725], 23, no. 2. Pre-Linn. 1725.1

— Opere fisico-mediche stampate e manoscritte . . . raccolte da Antonio suo figliuolo, &c. (Notizie della vita, e degli studi del Kavalier A. Vallisneri, tratte dalle memorie da lui vivente affidata a G. Co: di Porzia, &c.) 3 vols. Venezia, 1733. illust. fol. Pre-Linn. 1733.1

Valvasor, John Weichart [1641–1693] A full and accurate description of the wonderful lake of Zirknitz in that country [of Carniola]. Phil. Trans. Roy. Soc., 1687 (1688), 16, 411–426. Pre-Linn. 1688.1

Describes the fishing in this lake.

— Die Ehre des Herzogthums Crain, mit Eklärungen und Anmerkungen. 4 parts. Leybach, 1689. fol. Pre-Linn. 1689.1

Some fishes are described.

Van der Stell, Adrien. Poissons, écrevisses et crabes de diverses couleurs et figures extraordinaires que l'on trouve autour des îles Moluques, et sur les côtes des terres Australes; publiés par L. Renard. 2 vols. Amsterdam, 1718–19. fol. Pre-Linn. 1719.1

Van der Stell's collections are figured in vol. II, 1719.

The 1st ed.; the 2nd Amsterdam, 1754.

See also, Renard, L. in this section, 1718.1.

Vanière, Jacques [1664–1739] *Prædium rusticum*. Tolosæ [Toulouse], 1730. 12°. Pre-Linn. 1730.1

Fishes in canto xv; vivarium, canto xvi.

Other eds.: Tolosa, 1742; Paris, 1746; Am-

sterdam, 1749; Cologne, 1750; Paris, 1765 & 1780 (See in Vol. II. Vanière, J. 1765.1 & 1780.1); Paris, 1786.

For a late English version, see in Vol. II Vanière, J., 1809.1.

Varro, Marcus Terentius [c. 114–26 B. C.] *De re rustica libri tres*. (Included in *Scriptores rei rusticæ*. Venetiæ, 1472. fol.) Pre-Linn. 1472.1

Books II and III relate to fishes. In chap. 17 of the latter are described the famous great salt water ponds or pounds of the Rome of Varro's day.

For various eds. of this compilation, see under Anon. in this section. One of the best is:

M. T. Varronis de re rustica libri III. (In Gesner, J. M. *Scriptores rei rusticæ veteres latini*, etc. 1787, vol. I. 8°.)

A well-known English version is:

The three books of M. Terentius Varro concerning agriculture. Translated by the Rev. T. Owen, M. A. Oxford, University Press, 1800. 8°.

"There are German translations by G. Grosse, Halle, 1787–8, and by J. F. Mayer, Nürnberg, 1774 & 1781. In Panckoucke's 'Bibliothèque Latine-Française,' 1826, there is a French version by X. Rousselot accompanying the original; and another by F. Wolff in Nisard's 'Collection des auteurs Latins,' etc. 1850." — W. & S.

— Varronis opera omnia quæ extant. Cum notis J. Scaligeri, A. Turnebi, P. Victorii, & A. Augustini. His accedunt tabulæ naufragii, seu fragmenta ejusdem, etc. 6 parts. Durdrehti, 1619. 8°. Pre-Linn. 1619.1

Other eds. of the "Opera" are Augsburg: 1581, 1601 (said to be very accurate), & 1619.

Varro, Marcus Terentius, Cato, M., & others. *Libri de re rustica*. Parisiis, 1533. 506 p. fol. Pre-Linn. 1533.1

Other eds.: Paris, 1543; Lugduni, 1549; Leipzig, 1794–95.

See also Cato, M., Varro, M. T., & others, Pre-Linn. 1533.1.

Velius, Th. Chronyk van Hoorn, etc. Hoorn, 1740. Pre-Linn. 1740.1

Deals extensively with herring fisheries.

Other eds.: Hoorn, 1604, 1617, 1648.

Venables (Col.) Robert [c. 1612–1687] The experienc'd angler, or, angling improv'd; being a general discourse of angling, imparting many of the aptest wayes and choicest experiments for the taking of most sorts of fish in pond or river. London, 1662. xvi, 105, vi p. pls. Pre-Linn. 1662.1

"The engravings of fish are the same as those in [the first four editions of] Walton's "Compleat angler." — W. & S.

Other eds.: 1666, 1683, 1686; and a 6th, in 1825–1827. The 2nd edition was destroyed in the great fire, 1666.

The London reprints of 1825 and 1827 both contain a memoir of Venables. The latter is the better.

Venegas, Miguel [1680–1764]

See in vol. II, p. 580, 1757.1 & 1759.1.

Venzky, G. Von den Fischen Steinpietschen, als lebendigen Wetter-
Zeigern. Hamburg. Ber. Gelehrt.
Sachen, 1740, 485. Pre-Linn. 1740.1

Villeneuve, — [On the organ
of hearing in the sea horse] *Mercure de*
France, June, 1756. Pre-Linn. 1756.1

Walbaum says that this appeared in French
at Amsterdam, 1752. See also Villeneuve, Add.
1760.1.

Vincent, Levinus. Het tweede deel
of vervolg van het wondertoneel der
nature, ofte een korte beschryvinge
zo van bloedelooze, zwemmende, vlie-
gende, kruipende, en viervoetige ge-
klaauwde eijerleggende dieren, als van
hoornen, sculpen, koraalen, zee-heesters,
metallyke en in steen veranderde dingen
etc. Van de welke een zeer groote
meenigte word bevat in de kabinetten
van, etc. Amsterdam, 1715. 278 p.
7 pls. 4°. Pre-Linn. 1715.1

Fishes, p. 65–104. Copy, H.

This is the 2nd vol. of his "Wondertoneel der
Nature," etc. The 1st (43 p.), Amsterdam,
1706, contains no fishes. Other versions follow.
These not seen and not known to contain fishes.

— *Catalogus & descriptio ani-
malium, volatiliu, reptiliu & aqua-
tilium ut & animalium quadrupedum
tam oviparorum quam viviparorum ali-
orumque creaturarum rarissimarum ex
mundi plagis, etc.* La Haye, 1726. 4°.
Pre-Linn. 1726.1

Latin and French are in parallel columns.

Abstract in *Abh. K. Akad. Wiss., Berlin*, 6,
31.

*Catalogus van eene uitmiontende fraaje ver-
zameling van viervoetigen, vligenden &c. aieren,
zeecorallen &c. Zunde alles, meerendels het
van L. Vincent gekocht en nu onlangs nagelaa-
ten door P. Bout.* Hage, 1779. 8°.

Vincentius Bellovacensis (*Vincent
de Beauvais*, or *Vincent of Burgundy*).
[c. 1190–1264] For a brief sketch of the
life of the encyclopædist of the middle
ages, and for a short analysis of his
works, see article by T. A. Archer in
Encyclopædia Britannica, 1911, 11th
ed., vol. XXVIII, p. 90–91. Also J. B.
Bourgeat, "Études sur Vincent de
Beauvais, théologien, philosophe, ency-
clopédiste." Paris, 1856; and Ferguson,
"Account of the first edition of the
'Speculum majus' ('Speculum natu-
rale') 1473." *Trans. Arch. Soc., Glas-
gow*, 1844. Also Vogel, Aloys. 1843.1.

— *Incipit speculum naturale Vin-
centii beluacensz fratris ordinis predica-
torum.* Strasburg, 1473. fol.

Pre-Linn. 1473.1

Editio rarissima. Thought to be the 1st ed.,
though there is said to be one c. 1468–70.
Fishes, book xvii.

— *Speculum maius, quod alia
specula complectitur, naturale, doctri-
nale, morale, historiale.* 7 pts. *Argen-
tinæ*, 1473–1476. fol. Pre-Linn. 1473.2

The first ed. of the "Speculum majus" of
Vincent, consisting of the 4 books, and contain-
ing all known of natural history in his day, and
in fact of all knowledge at that time. It passed
through many eds. of which the rarest are:
Venice, 1483 (*Speculum naturale* only); 1493
& 1494 (all 4 *Specula*); Nuremberg, 1483, 1486,
1493. Later eds. are Venice, 1591, & Lyons,
1591. There is an ed. without date entitled:

— *Bibliotheca mundi sive specu-
lum majus.* [Basiliæ?]

According to Cuvier, the best ed. is:

— *Speculum quadruplex, naturale,
doctrinale, morale, historiale, in quo
totius naturæ historia; omnium scien-
tiarum encyclopædia . . . Omnia nunc
accurate recognita et distincte ordinata
. . . studio Theologorum Benedictino-
rum . . . in Academia Duacensi.* 4 vols.
Duaci, 1624. fol. Pre-Linn. 1624.1

"Speculi naturalis seu tomi primi liber xvii
agit de piscibus quæ ad eos referuntur."

"Speculi doctrinalis seu tomi secundi, liber
xv præter alia agit de piscibus."

Copies of early eds. in H., N. Y. P., L. C.,
H. E. H., Stan.

Visscher, Claes Janss. [1580–]
*Venationes ferarum, avium, piscium,
pugnæ bestiariorum et mutux bestia-
rum delinatæ ab Antonio Tempesta
t'Amsterdam gedrukt by Claes Janss.
Visscher anno 1627.* Amsterdam, 1627.
104 pls. Pre-Linn. 1627.1

Plates only; no text.

See note under Stradanus, J., this section.

— *Libellus varia genera piscium
complectens.* [Amsterdam, c. 1630].
Pre-Linn. 1630.1

Consists of plates drawn by Nicolas de Bruyn.

Visscher, Nic. J. *Piscium vivæ
icones, inventæ ab Andr. Collardo et
excusæ a N. J. Visscher.* Amsterdam,
1634. fol. Pre-Linn. 1634.1

Twenty-six plates, without descriptions. See
also Collart, A., Pre-Linn., 1634.1.

— *Delineationes vivæ animalium.*
Amstelodami, 1659. 4°. Pre-Linn. 1659.1

A number of fishes are figured.

It seems not improbable that the foregoing
plates of fishes were engraved and printed by
the man whose full name was Claes or Nicolaes
Janszoon Visscher.

Vlaming, Corneille de. *Zee-Tooneel.*
[c. 1715] Pre-Linn. 1715.1

Vlaming was an official of the Dutch East
Indies Co. in Bengal. His figures of oriental

Vlaming, C.

fishes, drawn under his care and inspection, probably by a native artist, served as the source of the figures in the first part of Renard's fishes of India. See note under Renard, L., this section, 1718.1. Vlaming's original drawings are, or were, in Muséum d'Histoire Naturelle, Paris.

Vogelhaupt, Jo. Progr. Strena, quæ sistit septem pisces, sive tot aquatilia maxime virtuosa. Anæmontæ, 1670. 4°. Pre-Linn. 1670.1

Voigt, M. Gottfried [1644–1682] For a memoir of his life, see *Nouv. Liter. German.* Hamburg, 1708, 438.

— (*præses*) *Dissertatio de piscibus fossilibus atque volatilibus.* Wittebergæ, 1667. 16 p. 4°. Pre-Linn. 1667.1

Johannes Heinrich Vulpius, *respond.*

— *Deliciæ physicæ de stillicidis sanguinis, lacrimis crocodili, catulis ursorum, piscibus fossilibus et volatilibus, etc.* Rostock, 1671. 8°. Pre-Linn. 1671.1

Review in *Phil. Trans. Roy. Soc.*, 1671, 6, 3017–3018.

— Beantwortung der Frage: Schlafen auch die Fische? (In his *Neu Vermehrten Phys. Zeitvertreibe.*, Stettin, 1721, 611 p. 12°.) Pre-Linn. 1721.1

Volckhart, Johannes. (*respond.*) *Dissertatio juridica de jure piscandi.* Jenæ, 1671. 4°. Pre-Linn. 1671.1
J. V. Beckmann, *præses.*

Vorstius, D. Conr. [1569–1622] *De piscatione amica collatio.* 1613. 4°. Pre-Linn. 1613.1

Vosmaer, Arnout [1720–1799] *Poissons, écrevisses et crabes . . . que l'on trouve autour des isles Moluques, et sur les côtes des Terres Australes . . .* 2. édition augmentée d'une préface par . . . A. Vosmaer. 2 vols. [in 1] 1754. illust. fol. Pre-Linn. 1754.1

See also Renard, L., Pre-Linn., 1718.1.

Vulpius, Johannes Henricus (*respond.*) *Ex historia naturali disputationem publicam de piscibus fossilibus atque volatilibus . . .* Wittebergæ, 1667. 16 p. 4°. Pre-Linn. 1667.1

M. G. Voigt, *præses.*

W

Wafer, Lionel [c. 1640—c. 1700] A new voyage and description of the Isthmus of America. London, 1696. 224 p. Pre-Linn. 1696.1

Fishes, p. 124-129, Indians fishing with nets and hands, p. 129-130.

The 1st ed.; 2nd & 3rd are, London, 1699 & 1704. French versions: Amsterdam, 1705; Paris, 1706. There are also German and Swedish translations. Wafer's voyage is also found as:

— A new voyage and description of the Isthmus of America. Giving an account of the author's abode there, the form and make of the country . . . To which are added, the natural history of those parts, by a Fellow of the Royal Society. (In A collection of voyages, etc. London, 1729, vol. III.) Pre-Linn. 1729.1

"An additional account of several beasts, birds, fishes, reptiles, &c. communicated by a member of the Royal Society," chap. II.

Wagner, Gottfried Jacob. Der in der edlen Fischerey wohlunterrichtende und erfahrene Fischer, welcher lehret, wie man soll die Teiche anlegen, bauen, warten, etc. Nürnberg, 1729. viii, 261 p. 13 pls. 8°. Pre-Linn. 1729.1

Other eds.: Nuremberg, 1730, 1739; Breslau, 1758, 1762; Vienna, 1785. The 1762 ed. bears title:

Der vollkommene Fischer, welcher zeigt wie man die Teiche anlegen, bauen, etc. Breslau, 1762. vii, 191 p. 8°.

Waldschmid, Wilhelm Ulrich [1669-1731] Lampetræ fluviatilis' anatome. Ephemer. Acad. Nat. Cur., 1697-98 (1700), dec. 3, ann. 5 & 6, 545-547. Pre-Linn. 1700.1

Included also in the "Amphitheatrum zootomicum" of M. B. Valentini, 1720. pt. II, p. 131.

Wallace, James (M. A.) [—1688] Description of the islands of Orkney. Edinburgh, 1693. pls. map. 16°. Pre-Linn. 1693.1

Contains accounts of the fishes.

Another ed., with additions by the author's son (James Wallace, M.D.), was published in 1700, and in 1863 the whole was edited and reprinted by J. Small. See Small, J., 1863.1.

Walton, Izaak [1593-1683] For biographies, see Marston, R. B. 1894.1; Westwood, T. 1884.1; Zouch, T. 1790.1. For a chronological list of editions of

"The compleat angler," 1593-1893, see Anon. 272, which should be credited to D. B. Fearing. Also notes below.

— The compleat angler or the contemplative man's recreation. Being a discourse of fish and fishing, not unworthy the perusal of most anglers, etc. London, 1653. xvi, 246 p. 8°.

Pre-Linn. 1653.1

The *editio princeps* of this famous work which has been reproduced many times and in many forms. Westwood & Satchell in the body of their work list 7 Pre-Linnæan and 79 Post-Linnæan eds. prior to 1882, on all of which they give some notes. These eds. they have either examined or have definite records of. On p. 369-370, they give a "skeleton chronicle" of 7 Pre- and 83 Post-Linnæan eds. to 1882, giving place, publisher, editor (where possible) and pages for each edition. Lists of eds. of the work of the "Father of Angling" are also found in the catalogue of the Bartlett collection. The Heckscher sale catalogue lists 171 items of the "Compleat Angler" and gives collations, and in addition lists 71 items of Waltoniana.

Cotton's name first appears in one of the 1676 eds. which is entitled as follows:

— The universal angler, made so, by three books of fishing. The first by Mr. Izaak Walton; the second by Charles Cotton Esq.; the third by Col. Robert Venables. All which may be bound together, or sold each of them severally. London, 1676. 8°.

Pre-Linn. 1676.1

This is the fifth and last ed. published during Walton's lifetime. The next bears date 1750 and is entitled:

— The compleat angler; or, contemplative man's recreation. In two parts. Containing I. A large and particular account of rivers, fish-ponds, fish and fishing: written by the ingenious and celebrated Mr. Isaac Walton. II. The best and fullest instructions how to angle for a trout and grayling in a clear stream. By Charles Cotton, Esq. London, 1750. 12°.

Pre-Linn. 1750.1

Notable reprints are those of 1808, 1824, 1825, 1836, 1844 & 1881. For notes on these, see Westwood & Satchell. In 1888, Marston brought out his superb "Lea & Dove" ed., it being the hundredth ed. of the "Compleat Angler." Probably the best American reprint is the 2-volume ed. issued at Boston in 1889.

The only translation into a foreign tongue known to us is:

Walton, I.

Der vollkommene Angler von Isaac Walton und Charles Cotton, herausgegeben von Ephemer, übersetzt von I. F. Schumacher. Hamburg, 1859. xii, 308 p. 10 pls. 8°.

Walton is said to have taken his idea of the angler from Nicholas Breton's "Wit's-Frenchman." 1597. (q. v.)

Walton, I., & Cotton, C. See **Walton, I.**, 1676.1; and **Cotton, C.** 1676.1

Wardenburg, C. Th. Dissertatio quaedam circa jus piscatus. Lugduni-Batavorum, 1757. 4°. Pre-Linn. 1757.1

Warren, G. An impartial description of Surinam upon the continent of Guiana in America. With a history of several strange beasts, birds, fishes, serpents, etc. London, 1667. 28 p. 4°. Pre-Linn. 1667.1

Mentions swordfish and electric eel.

Watson, Frederic. The animal-world displayed, or the nature, and qualities of living creatures described under the denominations of birds, beasts, fishes and serpents, etc. London, 1754. pl. 8°. Pre-Linn. 1754.1

A Dutch version is:

De dierlyke wereld ter beschonwinge opengezet. Uit het Engl. mit merklijke verbeteringen en aanterkeningen door C. Nozeman. Amsterdam, 1761. ill. 8°.

Watson, William [1715–1787] An account of Mr. Samuel Tull's method of castrating fish. Phil. Trans. Roy. Soc. 1754 (1755), 48, pt. 2, 870–874. Pre-Linn. 1755.1

This account excited great interest and was much copied or abstracted. See Gentleman's Mag. Hist. Chron. [Urban's], 21, 410. *Ibid.*, 25, 416. — London Mag., 24, 422. — Uitgez. Verh., 1757, 1, 389. Abstract in Comment. Lipsiens., 5, 595. — Mag. Anglais, 1765, (Jan.), art. 4. — Physikal. Oecon. Patriot., 1. Th., 337. — Hannover Mag., 1765, 589. — Phys.-Belustig., Berlin, 1755. — Comm. de Rebus, 5, 595. — Schauplatz Kunst Handw., 13. Th., 72.

Wecker, John. 18 books of the secrets of nature and art. First designed by John Wecker . . . augmented and enlarged by Dr. R. Read. London. 1660. fol. Pre-Linn. 1660.1

Book vii, pp. 134–8, "Secrets of fish and fishing."

Wedel, George Wolfgang [1645–1721] *De Trutta saxatilis*. Ephemer. Acad. Nat. Cur., 1673–74 (1688), 1. dec., ann. 4 & 5, 74–76. Pre-Linn. 1688.1

Weickmann, Christoph. Verzeichniss unterschiedlicher Thiere, Vögel, Fische, Meergewächse, Erz- und Bergarten, edlen und andern Steinen. Ulm, 1655. 8°. Pre-Linn. 1655.1

1st ed. not known. Later ones with slightly varying titles are:

— *Exoticophylacium Weickmannianum*, oder Verzeichniss unterschiedlicher Vögel, Thier, Fisch, Gewächs, Erz- und Bergarten, so in C. Weickmanns Kunst- und Natural-Cammer in Ulm zu sehen. Ulm, 1659. 12°.

Pre-Linn. 1659.1

— *Exoticophylacium Weickmannianum*. Oder: Verzeichnuss unterschiedlicher Thier, Vögel, Fisch, Meer-Gewächs, Ertz- und Berg-Arten, &c. so in der Kunst- und Natural-Kammer des weyland Herrn Christoph Weickmanns . . . zu finden. 1741. 77 p. 2 pls. 8°. Pre-Linn. 1741.1

Werlosching, Johann Baptist. De mirabile piscatione in certo Styriæ lacu, post certam piscium quantitatem captam tempestatem inducens. Misc. Acad. Nat. Cur. 1701 — 1705, dec. 3, ann. 9 & 10, 42. Pre-Linn. 1701.1

— *De exstruendis piscinis*. (In Ellis, William. *Modern Husbandman*, 1750, p. 59.) Pre-Linn. 1750.1

German translation, *Allgem. Magazin*, pt. II, 44. — *Dresdner Gel. Anz.*, 1757, 709.

Westbeck, Zacharias. Beschreibung der Sköt-Spiggs-Fischerey, und wie aus diesen Fische ein Oehl gesotten wird. König. Schwed. Akad. Abhandl., 1754, 15, 265. Pre-Linn. 1754.1

See note under Kästner, A. G., this section.

— *Beskrifning på sköt-spiggs-fisket, och huru olia kokas af denna fisk*. K. Svensk. Vetensk. Acad. Handl., 1754, 15, 261–266. Pre-Linn. 1754.2

Refers to *Gasterosteus aculeatus*.

Westphalus, J. C. *Piscinæ publicæ Lissensi prope delitium supernatante*. *Nouv. Liter. German.* Hamburg, 1705, 103. Pre-Linn. 1705.1

Whitbourne, Richard [*fl.* 1579–1627] A discourse and discovery of Newfoundland with many reasons to proove how worthy and beneficiall a plantation may there be made, after a far better manner than now it is, etc. London, 1622. 107, 15 p. sm. 4°. Pre-Linn. 1622.1

Reference to cod-fishing (p. 11–13) as carried on by the Basques in 1615.

A modern version is:

Westward Hoe for Avelon in the Newfoundland, as described by Capt. Richard Whitbourne of Exmouth, Devon. 1622. Edited and illustrated by T. Whitburn. London, 1870. 8°.

Williams, (Captain) Griffith. An account of the Island of Newfoundland, its trade and fishery. 1705. 35 p. 8°. Pre-Linn. 1705.1

Williams, Roger [c. 1604–1684] A key into the language of America, or an help to the language of the natives in New England. London, 1643.

Pre-Linn. 1643.1

List of Indian names for food fishes, and their English equivalents.

Reprinted in Coll. Rhode Island Hist. Soc., 1827, 1. Also in Rept. U. S. Fish Comm. 1871–72 (1873), 164–165. Comment on the above list, by J. Hammond Trumbull. Rept. U. S. Fish Comm. 1871–72 (1873), 165–169.

Williamson, John (angler). The British angler . . . comprehending . . . an exact description of the several kinds of fish that are found in the rivers and on the sea coasts of Great Britain, etc. London, 1740. vii, 318 p. illust. 3 pls. 12°.

Pre-Linn. 1740.1

Willisch, Chr. Gottfried. De Jona in pisce. Leipzig, 1721. 4°.

Pre-Linn. 1721.1

Another ed., Altenburg, 1732.

Willius, Johannes Valentinus. De aculeo piscis Fösing [Trachinus] observatio. Acta Med. Phil. Hafn., 1674–76 (1677), 3, 154–157. Pre-Linn. 1677.1

Willughby, Francis [1635–1672] For a memoir, see Jardine, (Sir) William, in his Naturalist's Library, vol. XXXVI, edition of 1843; vol. V, issue of 1845–46.

— Francisci Willoughby Ichthyographia ad amplissimum virum Dnum. Samuelem Pepys, Præsidium Soc. Reg. Londinensis, Concilium, et Socios ejusdem. Figuræ novæ, quæ non paucæ sunt notantur. Sumptibus Societatis Regalis. Londinensis, 1685. fol. Pre-Linn. 1685.1

Copy of the special engraved title-page to the plates of Willughby's great work. It is dated and the plates were presumably published in 1685, one year earlier than the text. This is often cited as a separate work and is so listed.

— Historia piscium libri quatuor . . . In quibus non tantum de piscibus in genere agitur, sed & species omnes, tum ab aliis traditæ, tum novæ & nondum editæ bene multæ, naturæ ductum servante methodo dispositæ accurate describuntur. Earumque effigies, quotquot haberi potuere, vel ad vivum delineatæ, vel ad optima exemplaria impressa; . . . Cum appendice historias & observationes in supplementum operis collatis complectente. Totum opus recognovit, coaptavit, supplevit, librum etiam primum & secundum integros adjecit Johannes Raius. Oxonii, 1686. 343, 30 p. 186 pls. fol. Pre-Linn. 1686.1

Dedicated to Samuel Pepys, and published at the expense of Bishop Fell and the Royal Society, of which the author and his friend and editor, John Ray, were among the original fellows.

Reviewed anonymously in Phil. Trans. Roy. Soc., 1686, 15, 1301–1308.

2nd ed., London, 1743. fol.

One hundred years later the plates in the above were reproduced as follows:

I (–X) Tabula . . . Pisces ex Raii emendata ichthyologia Willughbeii forma minori descripti, etc. Augusta Vindelicorum [Augsburg], 1786. obl. fol.

"The engraved title-page to the plates of Willughby's Historia Piscium is reproduced in miniature with the legend altered to read 'F. Willughbeii Ichthyographia. Totum opus recognovit, coaptavit, supplevit J. Ray . . . 1686. Nunc forma effigies edidit negotium Acad. Caesareo Franciscæ cum gratia et privilegio. S. C. Mey. Aug. Vind. A.D. 1786.'"

Title and note from catalogue of British Museum (Natural History).

— Appendix ad historiam naturalem piscium. (In his De historia piscium libri quatuor, etc. Oxonii, 1686. fol.) 30 p. Pre-Linn. 1686.2

i. Pisces Indiæ orientalis a Joanne Nieuhofs descripti.

ii. Pisces sequentes adjecit D. Martinus Lister.

iii. [Short notes from Ray, Tyson, & Robinson].

All these are listed elsewhere under these authors, as is the "Index piscium" of Cromwell Mortimer.

"Willughby was the most accomplished zoologist of this or any other country, for all the honour that has been given to Ray, as far as it concerns systematic zoology, belongs exclusively to him. He alone is the author of that system which both Ray and Linnæus took for their guide, which was not improved by the former or confessed by the latter." Swainson.

Winkelmann, Hans [Johann] Just. [1620–1699] Der amerikanischen neuen Welt Beschreibung, darinnen deren Erfindung, Lage, Thiere, Vogel, Fische, etc. Oldenburg, 1664. figs. 4°.

Pre-Linn. 1664.1

Dutch version, Amsterdam, 1667.

Winslow, Jacques Bénigne [1669–1760] Remarques et éclaircissements, par l'anatomie comparée, sur plusieurs articles de la 2de partie du traité de Borelli, de motu animalium. Mém. Acad. Sci. Paris, 1738, 65–96.

Pre-Linn. 1738.1

See Borelli, G. A., Pre-Linn. 1680.1.

Wolfart, Peter [1675–1726] Historiæ naturalis Hassiæ inferioris pars prima qua potiora et elegantiora hujus fossilia, figurata æque ac certa quandam et regulari figura carentia, etc. Der Natur-Geschichte des Nieder-Fuerstenthums Hessen. Erster Theil. Cassel, 1719. 52 p. 26 pls. fol. Pre-Linn. 1719.1

Various fossil fishes figured & described. Text in both Latin and German.

Wonnecken (Dr.) *Johann.* See **Cube**, *Johannes von*.

Wood, *William* [1580–1639] *New England's prospect.* A true, lively and experimentall description of that part of America, commonly called New England: discovering the state of that countrie both as it stands to our new-come English planters and to the old native inhabitants. London, 1634.

Pre-Linn. 1634.1

Refers to cod, salmon and mackerel fisheries of New England, also fishes of the Merrimac and Charles rivers, Mass.

Other eds.: 1635, 1639, London; & 1764, Boston. Reprinted in *Publ. Prince Soc.* Boston, 1865. Extract in *Rept. U. S. Fish Comm.* 1871–72 (1873), 161–162.

Woodward, *John* [1665–1728] *Fossils of all kinds, digested into a method suitable to their mutual relation and affinity, etc.* London, 1728. 56, 131 p.

Pre-Linn. 1728.1

Glossopetras, bufonites, etc., p. 13–19.

— A catalogue of the additional English fossils in the collection of J. Woodward, M.D. London, 1728.

Pre-Linn. 1728.2

Partes piscium, p. 52–53.

Also in "Foreign Fossils," p. 20–29 (which is a separately paged part of the above).

This forms vol. II of the following work, but is paged separately and is pre-dated.

— Attempt towards a natural history of the fossils of England (In a Catalogue of the English fossils in collection of J. Woodward, etc. 2 vols. in 1. 1729. sm. 8°.)

Pre-Linn. 1729.1

Vol. I, pt. II, A catalogue of English fossils in the collection of John Woodward. — *Piscium partes*, p. 82–86.

Vol. II, pt. II, A catalogue of the foreign fossils in the collection of John Woodward. — *Pisces eorumque partes*, p. 20–29.

Woodward's book seems to have been printed in parts, some dated and some not, but each part paged separately.

Copy, N. Y. P.

Worlidge, *John* [fl. 1669–1698] *Systema agriculturæ*, . . . To which is added, *kalendarium rusticum*; or the

husbandmans monethly directions . . . and *dictionarium rusticum*: or, the interpretation of rustick terms. London, 1669. xxviii, 278 p. illust. 4°.

Pre-Linn. 1669.1

Fishing, chap. XII.

Other eds., London, 1675, 1681, 1687, 1688, 1697, 1699, etc.

"Of fishing and fowling," p. 250–259, (1675 ed.).

Worm, *Ole* [1588–1654] *Museum Wormianum. Seu historia rerum rariorum, tam naturalium quam artificialium, tam domesticarum, quam exoticarum, quæ Hafniæ Danorum in ædibus authoris servantur, etc. Variis & accuratis iconibus illustrata.* Lugduni Batavorum, 1655. x, 388 p. illust. fol.

Pre-Linn. 1655.1

Fishes, p. 265–278, chaps. 10–15, book III.

— *De piscibus nonnullis lucentibus.* (In Bartholini, Th. *Epistolarum Medicinalium*. 1663. cent. 1, ep. 28, 118.)

Pre-Linn. 1663.1

Another ed., The Hague, 1740.

— *Dissertatio de glossopetris.* Hafniæ, 1686. 27 p. 4°. Pre-Linn. 1686.1

Wotton, *Edward* [1492–1555] *De differentiis animalium libri x, etc.* Lutetia Parisiorum [Paris], 1552. 220 p. fol.

Pre-Linn. 1552.1

The external and internal characters of fishes, methods of reproduction, etc., book VIII, p. 136–173.

Abstract in *Isis*, 1833, 1173–1182.

"Wotton methodised the zoology of Aristotle, and drew up the first formal classification of animals. His book is sagacious and careful, but dry." Miall, 1912.1.

Wren, *Christopher* [1675–1747] (The reproduction of eels) (In Birch, Thomas, *History of the Royal Society in London*. 4 vols. London, 1756. vol. III, p. 350.)

Pre-Linn. 1756.1

Wright, *W.* *The complete fisher: or, the true art of angling, by W. Wright, and other experienc'd anglers.* London, 1740. 12°. Pre-Linn. 1740.1

X

Xenocrates [396–314 B. C.] *Xenocratis de alimento ex aquatilibus animalium libellus*, Græce nunc primum editus, imperfectus. Idem Latine perfectior, J. B. Rasario . . . interprete. Accedunt C. Gesneri scholia, in ea *Xenocratis* que Grece *his camus*, etc. (In *Dubravius*, J. J. *Dubravii* . . . de piscinis et piscium qui in eis aliuntur naturis libri quinque. 1559. 4°.)
Pre-Linn. 1559.1

References to numerous fishes used as food.
Copy in library A. M. N. H., in both Latin and Greek, in 57 unnumbered pages, bound in same volume with, but forming a distinct unit apart from, the "*De piscinis et piscium*" of *Dubravius*. Found also in J. A. Fabricius "*Biblioth. Græca*," Hamburg, 1720, vol. IX. Another and excellent edition is by J. G. F. Frantzius. Frankfort & Leipsic, 1779.

Ximines, *Francisco* (editor). See **Hernandez**, *Francisco*, this section.

Y

Ysbrant, *E.* *Drie-jahrlge Reize naar China*. Amsterdam, 1704. 4°.
Pre-Linn. 1704.1
Not seen. Title from Agassiz.

Z

Zanardus, *Michael*. *Disputationes de universo elementari in tres partes divisæ* . . . In tertia de meteoris, & in his inter cetera de melle & manna, signis pestilentia, de aquis & piscibus, de metallis, lapidibus, plantis, serpentibus, quadrupedibus aliisque. Venetiis, 1619. 4°.
Pre-Linn. 1619.1
Other eds.: Coloniz, & Francofurti, 1620.

Zannichelli, *Giovanni Jacopo* [1622–1729] *Apparatus rariorum musæi Zannichelli*. Venice, 1720.
Pre-Linn. 1720.1
Some Monte Bolca fishes listed.

— *Enumerato rerum naturalium quæ in Museo Zannicheliano asservantur*. Venetiis, 1736. 132 p. 4°.
Pre-Linn. 1736.1
Some fossil fishes are described.

Zeidler, *Melchior* (*præses*) [1630–1686] *Exercitatio physica de respira-*

tione piscium, quam statuunt nonnulli. Jenæ, 1656. 4°.
Pre-Linn. 1656.1
Fab. Bernhardi, *respond.*

Zorgdrager, *Cornelius Gisbert* [c. 1650–170–] *Bloeyende opkomst der aloude en hedendaagsche Groenlandsche visschery, etc.* Amsterdam, 1720. xxxi, 330 p. 7 pls. frontisp. maps.
Pre-Linn. 1720.1

Other Dutch eds.: The Hague, 1727; Amsterdam, 1728; Delft, 1746.

— *Alte und neue Grönländische Fischerei und Wallfischfang* . . . Zu Ende ist allhier beigefüget eine summarische Nachricht von dem Bakkeljau- und Stockfischfang bei Terreneuf (in den nordlichen Theilen von America, aus den Schrifften des Herrn Danys gezogen) Leipzig, 1723. xxvi, 482 p. 7 pls. 6 maps. 4°.
Pre-Linn. 1723.1
Other German versions: Nuremberg, 1722 & 1750.

LIST OF PRE-LINNÆAN ANONYMOUS TITLES¹

Pre-Linnæan Anonymous. Allt
Schonbuch Recht und Gefell [M. S.
1383] Anon. 713

Land register of the Schönbuch in Württemberg. Rental paid for the fishing stream Steinach. Mentions the following fishes as occurring in the Steinach: Schuppfisch (*Squalius cephalus*); Bartgrundel (*Cobitis barbulata*); Ellritze (*Phoxinus laevis*); Grundel (*Gobio fluviatilis*); Gruppe (*Cottus gobio*).

For further data, see Tscherning, F. A., 1899.1

— Arte del pescare. Venezia, 1693.
12°. Anon. 714

— Avis sur une lanterne de cuir qui conserve la lumière sous l'eau même, très-utile pour la pêche, inventée par Mr. Scarlet. (In Observations curieuses sur toutes les parties de la physique. Paris, 1719. 8°.)

Anon. 715

German version: "Unterricht in der Fischerey." 2nd ed. Nürnberg, 1758.

Not seen; titles from Cloquet & Walbaum.

— Beschreibung des wunderbahren Fisches [Thynnus], so den 12. Novbr. Anno 1709 zu Ystädt in Schonen etc. an das Land geworffen worden, nebst desselben accuraten Abriess in Kpfr. gestochen. 1710. 4 p. 4°.

Anon. 716

— Beschreibung eines sehr grossen Fisches welcher bey Neapolis einen Fischer verschlungen. Berlin, 1721. 4°.

Anon. 717

— Bewährtes Mittel um eine Menge Fische mit der Angelruthe oder dem Netze zu fangen. Bremischen Mag., 1757, 1, 507. — London Mag., 1755.

Anon. 718

— Dit Boecxken leert hoe men mach voghelen vanghen metten handen. Ende hoe men mach visschen vangen metten handen. Ende oeck andersing. Ende oeck tot wat tyden vanden iare dat een yeghelyck visch tsynen besten is. Hier eyndet een boecxken dat seer profiteliick is voer allen visschers, ende vogheleers. [Antwerp, 1492?]. 8 leaves. 6 woodcuts. 4°. Anon. 719

This Flemish tract appears to have priority over the "Book of St. Albans," as far as fishing is concerned; that is, as a printed book. There

are a number of early German versions, appearing under the title of "Büchlin" or "Fischbüchlin," published between 1552 and 1700. One of these is included in the Fischbuch of Gregory Mangolt, published at Zurich in 1598. Three other editions are known: one in 4°, without place or date, having an identical title; the other, slightly changed in verbiage, in 1583 without place; and the third in 1584. For notes on these editions see Westwood & Satchell, p. 35-37. For an English translation, see Denison, A., 1872.1.

— Ein Büchlein wie man Fisch und Vögel fangen soll, mit 30 neuen und bewährten Recepten, auch zu welchen Zeiten im gantzen Jahr ein jeder Fisch am besten ze. Erfurt, 1610. 8°.

Anon. 720

Boehmer for same date and place gives a slightly variant title.

— A booke of fishing, with hooke and line, and all other instruments thereunto belonging. 1590. 4°.

Anon. 721

Another ed., 1606. Data from Boehmer.

— La canna de pescare. 1612. 250 p.

Anon. 722

Title only cited by Westwood & Satchell, 1883.

— Chür-fürstlicher Pfaltz, Forst- und Wald- auch Weid-, Wercks-, Jagd- und Fischerey- Ordnung. Heydelberg, 1711. 28, 148 p. table. sm. 4°.

Anon. 723

— The complete grazier; or, Gentleman and farmer's directory . . . also directions for making fish-ponds or canals, and for storing them, and ordering the fish in the best manner . . . London, 1677. xii, 252 p. 12°.

Anon. 724

Fish ponds, p. 244-252.

Other eds.: London, 1775 & 1776.

— The country gentleman's companion. 2 vols. London, 1753. 12°.

Anon. 725

Vol. I, chaps. xvii. Of fishing in general, and of making fish ponds; xviii. Of taking all sorts of fish: vol. II, chaps. viii. Of angling in general; ix. Of angling seasons; x. Of bait; of preserving fish from enemies; xii. Of ordering ponds.

Other eds.: Dublin, 1755; London, 1756.

— Cyanea, oder die am Bosphoro Thracio liegende hohe Klippe, von

¹ For lists of Anonymous Titles after 1758, see in volume II (p. 677-702) and in this volume (p. 1-3).

welchen zu sehen seyn das Vormeer Propontis, das schwarze Meer, Pontus Euxinus, Cypern, Candien &c. darinnen befindliche Thiere, Vögel, Fische &c. Augspurg, 1687. 26 pls. 8°.

Anon. 726

— De piscinarum utilitate & quæ in iis exstruendis piscibusque replendis observanda sunt. Oecon. Nachricht., Leipzig, 1751, 2.

Anon. 727

— [De piscium somno sive stupore hiemali] Oecon. Nachricht., 1754, 6.

Anon. 728

— Descriptio piscis, qui figuram habentis Eggfisch dicti. Gentleman's Mag. Hist. Chron. [Urban's], 1753, 23, 17. Abstract in Comment. Lips., 4, 61.

Anon. 729

— A description [and figure] of the cavalli marine [sea horse]. Gentleman's Mag. Hist. Chron. [Urban's], 1753, 23, 112. fig.

Anon. 730

Interesting early figure of sea horse. Copy, N. Y. P.

— A description of three hundred animals; viz., beasts, birds, fishes, serpents and insects. London, 1730. 212 p. 8°.

Anon. 731

Other eds.: London, 1734; (with slightly varying titles) 1736, 1738, 1740, 1753. Suppl. vols., London, 1739 & 1753. In the 1753 ed. are described 54 fishes. The 1753 supplement is:

— A description of a great variety of animals and vegetables, viz. beasts, birds, fishes . . . extracted from the most considerable writers of natural history. London, 1753. 90 pls. 8°.

Anon. 732

— Dictionnaire universel d'agriculture et . . . pêche . . . Avec des règles pour la volerie, la chasse et la pêche, etc. 2 parts. Paris, 1751. pls. 4°.

Anon. 733

— Diere palleys. . . . Van de vischen en monstre d'watere. Thantwerpen, 1520. sm. fol.

Anon. 734

"Dat derde tractaat beschrijft de naturen der beesten, monstren en de visschen der zee ende der wateren." — Bosgoed.

— Difesa della real mensa Ves-covile di Pozzuoli per l'esazzione della decima della pesca ne' mari di sua diocesi. Con li pescatori di Procida. Napoli, 1737. 8 leaves. 4°.

Anon. 735

— Dritter Theil des klugen Haus-Vaters. (Gründliche Nachricht von der

Fisch-Zucht, dem Ackerbau, Weismachs und Fischerey, etc.) Leipzig, 1721. 4°.

Anon. 736

— Dyalogus creaturarum moralizatus. Gouda, 1480. fol.

Anon. 737

Contains the earliest known printed figure of use of float in fishing.

1st ed.; 2nd, Cologne & Paris, 1481.

— Dyalogus creaturarum moralizatus. Gouda, 1482. fol.

Anon. 738

Leaves 38-44: De . . . piscatore, with several quaint woodcuts of fish, probably among the very earliest produced.

Many other editions issued but titles and dates not available. An old English version, supposed to be the 1st, is:

— The dialogues of creatures moralysed, applyably and edificatyfly to every mery and iocunde mater, of late translated out of Latyn into our Englysshe tonge right profitable to the gouernaunce of man. [1520?]. 164 leaves. woodcuts. 4°.

Anon. 739

Copies, 1st ed., J. P. M. & H. E. H.; 1481 ed., C. P.; 1482 ed. Gouda, H.

For a modern reprint, see, Haslewood, J., 1816.1; and for a late commentary, Klemming, G. E., "Dialogus creatuarum moralizatus" Samlaren. Tidskrift Utgifven af Svenska Litteratursällskapet. Arbetsutskott. Upsala, 1896. Argång 5, 36-42.

— Das edle Fisch-Buechlin, das ist: Ein sehr nuetzlicher Bericht, von der Fischerei ueberaus grosser Nützbarkeit; von der Fische Natur und Eigenschaft, etc. Nürnberg, [1700]. 190 p. 8°.

Anon. 740

Another ed., Cologne, [n. d.]

— Einige zur natürlichen Historie der Forellen gehörige Nachrichten, und was zu deren Vermehrung dienlich. Stutg. Sel. Phys. Oecon., 1750, 1, 112.

Anon. 741

— Encyclopédie japonaise [ante 1727].

Anon. 742

Under this heading, Valenciennes records four collections of native paintings of Japanese fishes extant in his day: one in the Bibliothèque du Roi; another in the Museum d'Histoire Naturelle de Paris; another in the collections of Sir Joseph Banks; and the fourth belonging to the Duc de Rivoli. The first comprised figures of 76 fishes; the 2nd & 3rd 83 & 84 each, and the last 31. The date can be fixed approximately since it is known that Kaempfer (q. v.) had some of these engraved for his "History of Japan."

— Extrait d'une lettre écrite à M. de la Chambre, qui contient les observations qui ont été faites, sur un grand poisson (*Renard marin*) disséqué dans le Bibliothèque du Roi le 24 July, 1667. Paris, [1667] pls. 4°.

Anon. 743

See also Anon. 769.

— Fishbuchlin, von der Natur und eigenschafft der Fischen. Item, wie man Fisch und Vögel fahen sol. Zu welcher zeit auch jeder Visch am besten sey. Straszburg, 1578. 8°.

Anon. 744

This has been attributed to Gregory Mangold.

— Fishing and hunting. . . . The art of fishing and sundry curious baits, viz. worms, flies, pastes, etc. . . . and how to procure and keep them for fishing; how to bring the fish to any part of the pond; to make worms for bait come out of the ground; the artificial cad-fly; how to take the fish in the night; the best time to angle in, etc. London, (1720?). 64 p. 8°.

Anon. 745

— Gedanken von dem Feig der Fische. Oecon. Physik. Abhandl., Lipsiæ, 1753, 428.

Anon. 746

— The gentleman angler. Containing short, plain and easy instructions whereby the most ignorant beginner may, in a little time, become a perfect artist in angling for salmon . . . gudgeon, etc. London, 1726. 12°.

Anon. 747

Other eds.: London, 1736, 1753, 1760, 1786, 1828. This last, "The anglers Guide," etc. is the best. Copies 1st and 2nd eds., N. Y. P.

— The gentleman fisher: or the whole art of angling. London, 1727. vi, 112 p. 8°.

Anon. 748

For 1st ed., see Anon. 785.

— Gewise und bewerthe Künste, wie man Fisch und Vögel fahen soll . . . etc. Item von der Natur unnd Eigenschafft vieler Fisch, etc. Nürnberg, 1612. 12°.

Anon. 749

— Harenga habita in monasterio Cluniacensi ad cardinalem de Lotharingia. Rhemis, 1566. 8°. Anon. 750

— Haus-Buch, . . . auch wie reiche und nutzbringende Fische-Teiche anzurichten, die Fische auf das beste zum merklichen Nutzen zu allen Zeiten des Jahrs wol und erspriesslich zu erhalten seyen, etc. Nürnberg, 1710. 12°.

Anon. 751

— Hausbuch Neu-Curioses, eidgenössisch-schweizerisches. Basel, 1705.

Anon. 752

Chap. xv, Swiss fishes.

Reprinted, Pfäffikon, 1897.

— Herbarum, arborum, fruticum, frumentorum et leguminum, animalium

terrestrium, volatiliu, aquatiliu aliorumque, quorum usus est in medicina imagines ad viuum depictæ, una cum earundem nomenclaturis. Francofurti, 1536, pt. 1 and 2. 4°.

Anon. 753

This may have been the basis of a similar work by Charles Estienne, 1536.1 (q. v.).

Other eds. are: Paris, 1536, 1545, & 1554; Leyden, 1548; Frankfort, 1546 (German), & 1552.

— Histoire des animaux à quatre pieds, des oiseaux, des poissons &c. Paris, 1619. 8°.

Anon. 754

— Histoire naturelle des oiseaux peu communs & des autres animaux rares & qui n'ont pas été décrits, consistant en quadrupèdes, reptiles, poissons, insectes &c. 7 vols. Londres, 1751-63. 4°.

Anon. 755

— Histoire naturelle du Languedoc. Paris, 1728. 4°.

Anon. 756

Poissons, p. 549-578.

Another ed., Paris, 1737, contains descriptions of fossil fishes and of the capture of the mullet.

— Histoire universelle des poissons et autres monstres aquatiques. Paris, 1584. 12°.

Anon. 757

— Kurzer Begriff der edlen Jägerei . . . nebst einem Anhang von der Fischerei, etc. Nordhausen, 1730. 36 pls. 8°.

Anon. 758

"Fischerei," p. 1-136.

Other eds.: Nordhausen, 1733, 1742, 1745.

— Liber œconomicus (des Jesuitkloster zu Passau an der Donau, MS. 1709-1763)

Anon. 759

This "Haushaltungsbuch" of the Passau monastery contains, according to J. Wimmer, interesting data concerning fish of the Danube region.

— Mémorial alphabétique des matières des eaux, forêts, pêches et chasses, avec les édits. Paris, 1737. 4°.

Anon. 760

— El modo como se puede destruyr cada uno la pesca de los harengues de manera que no de frute ninguno. 1632.

Anon. 761

In the Burgundian Library, Brussels.

— Nachricht vom Hayfisch. Ges. Erzähl., Hamburg, 1754, 3. 8°.

Anon. 762

— La nature et propriété des poissons et autres monstres aquatiques, qui hantent et habitent aux mers, rivières et estangs; avec leurs pour-

traicts et figures exprimez au plus près du naturel. Paris, 1584. 16°.

Anon. 763

An earlier ed. exists, date not known.

— Neue und bewahrte Recepten, Fische und Vogel zu fahen mit den Handen, Reussen, Angeln, Hammen, Netzen. 1580. 8°. Anon. 764

This appears to be a part of the 1552 edition of the "Büchlin" (q. v.), Anon. 720.

— Neuw Jag unnd Weydwerck Buch, das ist eine gründtliche Beschreibung vom Anfang der Jagten . . . vom Fisch, Krebs, Otter vnd Biber Fang, wie mans mit Netzen, Reusen, Angeln, Kasten, Otter vnd Biberhunden, vnd allerley darzu gehoriger Gelegenheit fahen sol . . . Franckfurt am Meyn, 1582. fol. Anon. 765

— New and excellent experiments and secrets in the art of angling: being directions for the whole art. London, 1677. 12°. Anon. 766

— A new general collection of voyages and travels, etc. 4 vols. London, 1745-47. illust. Anon. 767

Consists of abstracts or abbreviations of a large number of voyages and travels with numerous figures and descriptions of fishes. Copy, A. M. N. H.

— Observations faites sur un grand poison [sic] [*Vulpecula marina*], & un lion, disséqués dans la Bibliothèque du Roy à Paris, le 24 & 28 Juin, 1667. Phil. Trans. Roy. Soc., 1667, 2, 535-537. Anon. 768

Undoubtedly based on Anon. 743.

Both these references have to do with the dissection by Claude Perrault (q. v.) of the fox shark. Antedating Perrault's own description (1671) of the spiral valve, they are among the earliest known references to this. For the earliest, see Steno, N., Pre-Linn. 1664.1.

— A perfect description of Virginia: being a full and true relation of the present state of the plantation, their health, peace & plenty: the number of people, with their abundance of cattell, fowl, fish, &c. London, 1649. 4°. Anon. 769

Contains a list of 32 fishes. Reprinted in Force's Historical Tracts, 2, tract 8. Extract in Rept. U. S. Fish. Comm. 1871-72 (1873), 170-171.

— Pertinente beschryvinghe van Guiana, gelegen aen de vaste kust van America, waerin kortelyck verhaelt wordt, het aenmerckelyckste dat in en omtrent het landt van Guiana valt, etc. Amsterdam, 1676. 12 & 55 leaves. 4°. Anon. 770

Fishes, p. 37-41.

Copy in Surg. A German version is:

Eigentliche Beschreibung des Landes Guiana, etc. 1677.

— Pesci che nascono nel Danubio, e volatili che vivono lungo d'esso delineati ed incisi in tavole CXII. Bologna, [n. d.] fol. Anon. 771

— Piscis vel potius testudinis aquaticæ nova species descripta. Mag. Toscano, Livorno [Leghorn], 1754, 2, 363. Anon. 772

— Poissons des Indes Orientales; recueil de 66 dessins en couleurs. fol. Anon. 773

"Ces dessins qui semblent avoir été faits en Hollande au commencement du 18. siècle, sont d'une exécution remarquable."

The copy in A. M. N. H. has the water-color figures cut out of the original drawing paper and pasted on the leaves of the volume.

— Principales merveilles de la nature, ou l'on traité de la terre, des fleuves, montagnes, des choses les plus rares animaux, poissons, plantes, diamants etc. 2 vols. Amsterdam, 1745. 8°. Anon. 774

— Regimen sanitatis Salernitanum, etc. Montpellier, 1480. 4°. Anon. 775

An esteemed work whose merit and popularity are attested by the vast number of editions printed. There were six issued in 1480, the above being the *editio princeps*. Twenty eds. were published before 1500, and over 160 by 1830. There are translations into French, German, English, Dutch, Italian, Polish and Bohemian. For bibliographic details of these eds. and versions, see:

Regimen sanitatis salernitanum: a poem on the preservation of health in rhyming Latin verse. With an introduction and notes by Sir Alexander Croke. Oxford, 1830 [with ill. from the German eds. of 1559, 1568, & 1573] Copy Col.

The following eds. (both in Col. Univ. library) have been examined by us.

— Regimen sanitatis Salerni: or the school of Salernes regiment of health . . . Whereunto is annexed a necessary discourse of all sorts of fish, in use among us, with theyr effects, appertayning to the health of man. London, 1634. Anon. 776

Various fish named and their value as food discussed, p. 207-218.

— Schola Salernitana de valetudine tuenda. Lutitiæ Parisiorum, 1672. Anon. 777

Various fishes as food and the proper choice of them, p. 673-722.

— Scriptores rei rusticæ. Venice, 1472. fol. Anon. 778

The 1st ed. of this compilation, which was many times republished. Other 15th century eds.: Reggio d'Emilia, 1482, 1496, & 1499; Bologna, 1492. Copies of these early issues in H., C., J. C., & H. E. H.

Some later eds. are: Basel, 1521 & 1576; Leyden, 1542, 1549, & 1604; Paris, 1545, 1569, 1581, & 1585; Dordrecht, 1619; Amsterdam, 1623, & 1730; Leipsic, 1735, & 1744; Mannheim, 1781; Biponti, 1782-88; Leipsic, 1794-97.

The most famous eds. are the last, by J. G. Schneider, and those of Leipsic, 1735 and Biponti, 1787, by J. M. Gesner (Both in N. Y. P.).

This compilation recounts some of the earliest known efforts at pisciculture.

For further references, see in this section: Cato, Columella, Palladius, & Varro.

— The sportsman's dictionary; or, the country gentleman's companion . . . with full and particular instructions for . . . fishing, etc. 2 vols. London, 1735. 4°. Anon. 779

Other eds.: London, 1744, 1778, 1782, 1785, 1786 (Dublin), 1792, 1800, 1807.

— Treatise of fishing, with the art of angling. 1614. 4°. Anon. 780

— [Ut pisces compresso aëre sub glacie stupidi reddantur.] Oecon. Nachricht., 1754. 5. Anon. 781

— Von des Aals Laichen. Samml. Nat. u. Med., Kunst u. Litt.-Gesch. Breslau, 1718, 1224. Anon. 782

— Von einem in Rom gefangenen Stöhr. Samml. Nat. u. Med., Kunst u. Litt.-Gesch. Breslau, 1718, 5. Vers., 1531. Anon. 783

From Boehmer. Walbaum says Tentam. 32, p. 433.

— Waidweryk . . . Fisch zufahen mitt Netzen, Reusen, Angeln, Kasten . . . Und wie man alles darzu dienlich, bereyten, auffziehen, halten, und machen soll. Augsburg, c. 1525. 20 leaves. 4°. Anon. 784

Other eds. are: Strassburg, 1530, & Frankfurt-a.-M., 1531.

— The whole art of fishing. Being a collection and improvement of all that has been written upon this subject, with many new experiments . . . To which is added the laws of angling. London, 1714. 112 p. 8°. Anon. 785

Copy, N. Y. P. See also Anon. 748.

— Ein wunder künstreiches Büchlin, wie man Fisch, Krebs, und Vögel fahen soll. Mit gar vil bewehrten Recepten, etc. Von vil erfarnen Weydleuten, und Fischern, von neuwem zugericht, etc. Und auch hie bey zu welcher Zeit ein yeder Fisch am besten ist. Strassburg, c. 1531. 24 p. 12°. Anon. 786

Another ed. with almost identical title, Bern, 1552. 8°.

This is a translation of the early Flemish treatise on fishing commonly designated as "Boecxken" (Anon. 719), printed in black letter about 1492. On the last page of the 1552 edition is an interesting list of nicknames and similitudes of fish.

IV

GENERAL BIBLIOGRAPHIES WHICH INCLUDE REFERENCES TO FISHES.¹

— An analytical subject bibliography of the publications of the (U. S.) Bureau of Fisheries, 1871-1920. By Rose M. E. MacDonald. (Append. V to) Rept. U. S. Comm. Fisheries, 1920. 306 p. 8°.

— Archiv für Naturgeschichte, 1835-1919. 85 vols. Berlin, 1835-1920. 8°.

Each year's issue in 2 pts., memoirs and bibliography.

— The Bartlett collection. A list of books on angling, fishes, and fish-culture in Harvard College library. By L. R. Albee. Cambridge (Mass.), 1896. 180 p. 8°.

This includes, with many additions, the titles in Bartlett, J. 1882.1.

— Bibliografia ed inventario delle ittioliti terziarie di Monte Bolca conservate nel Civico Museo di Verona. By Vittorio dal Nero. Madonna Verona, 1911, 2, 120-126; 3, 133-167; 1912, 4, 246-260.

— Bibliographia zoologica (adhuc diario "Zoologischer Anzeiger" annexa) condita ab J. Victor Carus, edidit, sub cura doctoris Herbert Haviland Field. Concilium Bibliographicum. 29 vols. Zurich, 1896-1916.

See also "Zoologischer Anzeiger."

— Bibliographia zoologiæ et geologiæ. A general catalogue of all books, tracts, and memoirs on zoology and geology. By Louis Agassiz. Corrected, enlarged, and edited by H. E. Strickland (and Sir Wm. Jardine (for vol. IV)). 4 vols. London, 1848-54. 2259 p. 8°.

— A bibliographical catalogue of the Waltonian library belonging to the estate of R. W. Coleman. By Joseph Sabin. New York, 1866. 149 p. 8°.

This includes the works listed in Bethune, G. W. 1847.1. A sale catalogue (36 p. 4°.) of this collection is dated London, 1897.

— Bibliographie der deutschen naturwissenschaftlichen Litteratur. [1901-1914] 18 vols. Jena & Berlin, 1902-14. 8°.

Vols. for 1904-14 published at Berlin.

— [Bibliographie d'] Ichthyologie. By Hippolyte Cloquet. Dictionnaire des Sciences Naturelles. Paris, 1821, vol. XXII, 443-548.

— Bibliographie des travaux scientifiques (sciences mathématiques, physiques et naturelles) publiés par les sociétés savantes de la France depuis l'origine jusque'en 1888. By J. Deniker. Paris, 1916. 607 p. 4°.

Vol. I, Ain-Orne, all published to date.

— Bibliographie der Veröffentlichungen [der wissenschaftlichen Vereine und Gesellschaften Deutschlands im neunzehnten Jahrhundert] seit ihrer Begründung bis auf die Gegenwart. By Johannes Müller (librarian). Berlin, 1883-87. 878 p. 4°.

See also Müller, J. (librarian) 1883.1.

— Bibliography and catalogue of the fossil vertebrates of North America. By Oliver Perry Hay. Bull. U. S. Geol. Survey, 1902, no. 179, 868 p.

This includes the titles on fossil fishes found in Darton, N. H. 1896.1; Weeks, F. B. 1902.1; and Warman, P. C. 1893.1, and 1901.1. For titles since 1902, see the following:

¹ There are here brought together the chief bibliographies known to us containing extensive references to Fishes, Fisheries, Pisciculture, and Angling.

Reference to special bibliographies on particular or restricted subjects will be found throughout the Subject Index under their respective sections. In general, citations indicated by a star or by black-faced type will be found to contain special bibliographies of the subject.

— Bibliography of North American geology, palæontology, etc. Bull. U. S. Geol. Surv., 1901-19.

I. 1901-05. By F. B. Weeks. Bull. 1906, no. 301. 770 p.

II. 1906-07. By F. B. Weeks & J. N. Nickles. Bull. 1908, no. 372, 317 p.

III. 1908-18. By J. N. Nickles. Bull. 1909-19, nos. 409, 444, 495, 524, 545, 584, 617, 645, 665, 684, 698.

— A bibliography of fishes. By Bashford Dean. 3 vols. New York, 1916-23. 8°.

Vols. I & II, enlarged and edited by C. R. Eastman, 1420 p.

Vol. III, extended and edited by E. W. Gudger; assisted by A. W. Henn.

— Bibliography of fishes of the Pacific coast of the United States to the end of 1879. By Theodore N. Gill. Smithsonian. Misc. Colls., 1882, 23, 1-73.

— A bibliography of vertebrate embryology. By C. S. Minot. Mem. Boston Soc. Nat. Hist. 1886-93 (1893), 4, 487-618.

— Bibliotheca anatomica quo scripta ad anatomiam et physiologiam facientia a rerum initiis recensentur. By Albrecht von Haller. 2 vols. Tiguri, 1874-77. 1686 p. 4°.

— Bibliotheca animalis oder Verzeichniss derer meisten Schriften, so von Thieren und deren Theilen handeln, etc. By Franz Ernst Brückmann. Wolfenbüttel, 1743. 277 p. 8°.

A supplementary volume was issued, 1747.

— Bibliotheca historico-naturalis, . . . oder systematisch geordnete Uebersicht . . . der auf dem Gebiete der gesammten Naturwissenschaft neuer-schienenen Bücher, etc. 38 vols. Göttingen, 1851-88. 8°.

— Bibliotheca historico-naturalis. Verzeichniss der Bücher über Naturgeschichte . . . welche in den Jahren 1700-1846 erschienen sind. Von Wilhelm Engelmann. Leipzig, 1846. 786 p. 8°.

Continued as "Bibliotheca zoologica. Verzeichniss," etc. (q. v.).

— Bibliotheca Hungarica historiae naturalis et matheseos. Magyarorszig természettudományi és matematikai Könyveszete, 1472-1875. By Jossef Szinnyi and Jozef Szinnyi (the younger). Budapest, 1878. 1007 p. 8°.

— Bibliotheca ichthyologica sive historia litteraria ichthyologiae in qua

recensio fit auctorum, qui de piscibus scripsere, librorum titulis, loco & editionis tempore, etc. By Peter Artedi. Lugduni Batavorum, 1738. 66 p. 8°.

Part i of Artedi, P. Pre-Linn. 1738.1.

For a revised and augmented ed., see next title.

— Bibliotheca ichthyologica, seu historia litteraria ichthyologiae, etc. Emendata et aucta, etc. By Johann Julius Walbaum. Grypeswaldiae, 1788. 230 p.

Part i of "Petri Artedi renovati," etc., by J. J. Walbaum, 1788.1.

— Bibliotheca, ordine chronologico recensens Danicae, Norvegiae, Islandiae & Holsatiae auctores et libros, scientias naturales tractantes, etc. By Martin Thrane Brünnich. Pt. II of his "Litteraria Danica Scientiarum Naturalium." Hafniae & Lipsiae, 1783. 242 p.

— Bibliotheca ichthyologia et piscatoria. Catalogue de livres et d'écrits sur l'histoire naturelle des poissons et des cétacés, la pisciculture, les pêches, la législation des pêches, etc. By D. Mulder Bosgoed. Harlem, 1874. 474 p. 8°.

Second title-page is in Dutch. For an earlier ed., see Bosgoed, D. M. 1871.1.

— Bibliotheca piscatoria. A catalogue of books on angling, the fisheries and fish-culture, with bibliographical notes, etc. By Thomas Westwood & Thomas Satchell. London, 1883. 397 p. 8°.

This work includes the titles found in and hence supersedes: Bethune, G. W. 1847.1; Ellis, H. 1811.1; Pickering, W. 1836.1; Satchell, T. 1882.1; Smith, J. R. 1856.1; Westwood, T. 1861.1. For a supplement, see "A list of books on fish," etc., by R. B. Marston, 1901.1.

— Bibliotheca regni animalis atque lapidei, seu recensio auctorum et librorum, qui de regno animali et lapides . . . in usum naturalis tractant, historiae studiosorum. By Laurentius Theodorus Gronovius. Lugduni Batavorum, 1760. 326 p. 4°.

— Bibliotheca scriptorum historiae naturalis, oeconomiae, aliarumque artium ac scientiarum ad illam pertinentium realis systematica. By George Rudolph Boehmer. 2 vols. (in 2 pts. each) Lipsiae, 1785-86. 2690 p. 8°.

The most extensive bibliography of natural history ante Agassiz & Strickland.

— Bibliotheca scriptorum historiae naturalis omnium terrae regionum inservientium; historiae naturalis Helvetiae prodromus. Accedit Jacobus Le Long de scriptoribus historiae naturalis

Galliæ. By Johann Jacob Scheuchzer. Tiguri, 1751. 251 p. 8°.

An earlier ed., Tiguri, 1716.

— *Bibliotheca scriptorum venaticorum continens auctores, qui de venatione, sylvis, aucupio piscatura . . . commentati sunt*. By Georg Christopher Kreysig. Altenburgi, 1750. 190 p. 8°.

— *Bibliotheca zoologica Danica, 1876–1906*. Fortegnelse over Danmarks zoologiske literatur, 1876–1906. By Svend Dahl. Kjøbenhavn, 1910. 262 p. 8°.

— *Bibliotheca zoologica Fennicæ*. By O. M. Reuter and Alexander Luther. Acta. Soc. Faun. Flora Fenn., 1909, 24, no. 1, 361 p.

Bibliotheca zoologica. Verzeichniss der Schriften über Zoologie . . . welche vom Jahre 1846–1860 selbständig erschienen sind, etc. By J. Victor Carus and Wilhelm Engelmann. 2 vols. Leipzig, 1861. 2140 p. 4°.

This is a continuation of "*Bibliotheca historico-naturalis*," etc., (q. v.), and in turn is continued as:

— *Bibliotheca zoologica II. Verzeichniss der Schriften über Zoologie . . . welche vom Jahre 1861–1913 selbständig erschienen sind*. By O. Taschenberg. 7 vols. Leipzig, 1887–1913. 6072 p. 4°.

— *Bibliothek der Forst- und Jagd-Wissenschaft; oder Verzeichniss der in älterer und neuer Zeit, besonders aber vom Jahre 1750 bis gegen Ende des Jahres 1842 in Deutschland erschienenen Bücher über alle Theile des Forst- und Jagdwesens, über die Fischerei, etc.* By T. C. F. Enslin & W. Engelmann. Leipzig, 1843. 102 p. 8°.

2d ed. revised by Engelmann: 1st by Enslin, 1823. Continued as:

— *Bibliothek der Forst- und Jagd-Literatur. Ein Verzeichniss der über alle Theile des Forst- und Jagdwesens und über Fischerei in Deutschland erschienenen Schriften umfassend dem Zeitraum vom Jahre 1842 bis zum Jahre 1856, etc.* By F. W. Schneider. Berlin, 1856. 63 p. 8°.

— *Bibliothek der gesammten Naturgeschichte*. By Johann Fibig & B. S. Nau. 2 vols. Frankfurt-am-M., 1789–91.

— *Bibliothèque physique de la France, ou liste de tous les ouvrages tant imprimées que manuscrits qui traitent de l'histoire naturelle de ce royaume*. By L. A. P. Herissant. Paris, 1771. 8°.

— *Bidrag till öfversigt af Sveriges ichthyologiska literatur*. By Frederic Lundberg. Stockholm, 1872. 56 p. 8°.

— *Catalogue of the books, manuscripts, maps and drawings in the British Museum (Natural History)*. 5 vols. London, 1903–1915. 2403 p. 4°.

— *A catalogue of the collection of books on angling belonging to Dean Sage*. New York, 1896. 245 p. sq. 8°.

A supplement (24 p.) was issued in 1904.

— *Catalogue of the library of the late John G. Hecksher*. 3 parts. New York, 1909. 382 p. 12°.

Lists 2442 items in ichthyology, angling, and fisheries.

— *Catalogue of scientific papers (1800–1900) compiled by the Royal Society of London*. 17 vols. London, 1867–1921. 4°.

Issued in 4 series (4th incomplete), and commonly known as the "*Royal Society Catalogue*."

— *Catalogus doctorum virorum, qui præter Oppianum de venatione et piscatione, aut rebus ad eam pertinentibus scripserunt*. By Conrad Rittershusius in his "*Prologomena in Oppianum*." Lugduni Batavorum, 1597. leaves 74 & 75.

The oldest known list of writers on fish and fishing.

— *Check list of books on angling, fish, fisheries, fish-culture, etc., in the library of D. B. Fearing*. New York, 1901. 138 p. 4°.

This remarkable collection is now in the Harvard library.

— *Concilium Bibliographicum*. H. H. Field, editor. Zurich, 1896–1920.

A system of bibliographical cards arranged alphabetically by authors, and numerically by subjects. See also "*Bibliographia zoologica*."

— *Deliciæ Cobresianæ. Büchersammlung zur Naturgeschichte*. By J. P. Cobres. 2 vols. Augsburg, 1781–82. 956 p.

— *Elementi per una bibliografia italiana intorno all' idrofauna agli allevamenti degli animali acquatici e alla pesca*. By Guelfo Cavanna. Firenze, 1880. 170 p. 8°.

— Exposé des titres et travaux scientifiques (1869-1896). By Alfred Giard. Paris, 1896. 300 p. 4°.

— Index auctorum, qui de piscibus eorumque vario usu scripserunt, quorumque in hoc libro aut ab Artedio mentio facta est, ad seculum deductus. By J. G. Schneider in his "Petri Artedi Synonymia piscium Graeca et Latina emendata . . . Sive Historia piscium . . . ab Aristotelis usque ævo ad seculum XIII deducta," etc. Lipsiæ, 1789. 227-246.

— International catalogue of scientific literature. London. 8°.

I. Section K. Palæontology. 13 vols. 1903-1916.

II. Section N. Zoology. 1904-1914.

The first 5 vols. of Section N (1904-1907) appeared as separate issues; those for 1908-1914 in and as the Zoological Record with 2 title pages.

— A list of books on fish, fishing, and fisheries, to supplement the "Bibliotheca piscatoria" of Westwood & Satchell published in 1883, etc. By R. B. Marston. London, 1901. 24 p. 8°.

Literatur zur Fischkunde. By H. Lichtenfelt. Bonn, 1906. 140 p. 8°.

— Literaturæ scientiæ rerum naturalium in Dania, Norvegia & Holsatia usque ad annum 1829, etc. By Mathias Winther, Havnæ, 1829. 233 p. 8°.

— The record of zoological literature, 1864-69. 6 vols. London, 1865-70. 4°.

Continued as "The Zoological Record." (q.v.).

— Reportorium commentationem a societatibus literariis editarum scientia naturalis. By J. D. Reuss. 2 vols. Gottingiæ, 1801-1802. 988 p.

— Systematisches Verzeichniss aller derjenigen Schriften welche die Naturgeschichte betreffen, von den ältesten bis auf die neuesten Zeiten. By Christ. Fred. Prange. Halle, 1784. 446 p.

— Udsigt over Danmarks zoologiske literatur med en indledende fremstilling af de videnskabelige grundsætninger for naturvidenskabens især zoologiens studium. By C. C. A. Gosch. 2 vols. Kjøbenhavn, 1875-78.

3d ed.; 1st, 1870, 360 p.; 2d, 2 vols., 1873.

— Verzeichniss der Schriften und Abhandlungen, die norwegischen Fischereien betreffend, in chronologischer Ordnung zusammengestellt. By Thorvald Boeck. Christiania, 1880. 8°.

A revised and extended ed. of Boeck, T. 1866.1.

— Zoologischer Anzeiger, 1878-1895. 18 vols. Leipzig, 1878-95. 8°.

For the years named, issued in 2 parts, "Mittheilungen" & "Litteratur." Succeeded in 1896 by "Bibliographia Zoologica." (q.v.).

— Zoologischer Jahresbericht. Naples, 1879-1910 (1880-1911). 8°.

An abstract and bibliographical journal.

— The zoological record, being records of zoological literature, 1870-1919. 56 vols. London, 1871-1921. 4°.

For earlier issues, see "The Record of Zoological Literature."

V

VOYAGES AND EXPEDITIONS WHICH RELATE TO FISHES¹

"Albatross." — [Explorations of the U. S. Fish Commission steamer "Albatross" in the north Pacific, 1888-1900.]

Fishes, C. H. Gilbert, 1890.3, 1892.2, 1895.1, 1897.1, 1908.1.

— Exploration of the west coast of Mexico, Central and South America, and off the Galapagos Islands . . . by the U. S. Fish Commission steamer "Albatross," during 1891.

Fishes, C. H. Gilbert, 1891.4; S. Garman, 1899.1.

— [Explorations in the northwest Atlantic by the U. S. Fish Commission steamer "Albatross."]

Fishes, G. B. Goode, & T. H. Bean, 1896.1.

— The expedition to the eastern tropical Pacific by the . . . "Albatross" . . . 1904-05.

Sharks' teeth, C. R. Eastman, 1906.3.

— [The Philippine cruise of the U. S. Fisheries steamer "Albatross," 1907-10.]

Fishes, L. Radcliffe, 1911.1, 1912.1, 2, 1913.1, 2; H. M. Smith, 1912.2, 6, 1913.2.

— [The U. S. Bureau of Fisheries steamer "Albatross" in Japanese waters in 1906.]

Fishes, C. H. Gilbert & C. V. Burke, 1912.2; J. O. Snyder, 1912.1, 3.

"Alert" and "Discovery." — Voyage to the polar sea during 1875-76 in H.M.S. "Alert" and "Discovery."

Fishes, A. Günther, 1877.1, 3, 8, 1878.2.

Algeria. — L'exploration scientifique de l'Algérie pendant . . . 1844-67.

Fishes and reptiles, A. Guichenot, 1850.2.

"Amelia." — Resultados das investigações científicas feitas a bordo do yacht "Amelia" (in the Mediterranean Sea and eastern Atlantic?).

Fishes, Dom Carlos de Bragança, 1899.1, 1904.1.

"Assistance." — The [Arctic] expedition in H.M.S. "Assistance" . . . during . . . 1852-54, under . . . Sir E. Belcher.

Fishes, J. Richardson, 1855.1.

"Astrolabe." — Voyage . . . de "L'Astrolabe" [autour du monde] . . . pendant . . . 1826-29, sous . . . M. J. Dumont d'Urville.

Fishes, J. R. C. Quoy, & P. Gaimard, 1834.1.

"Astrolabe" and "Zélée." — Voyage au Pôle Sud et dans l'Océanie sur . . . "L'Astrolabe" et "La Zélée" . . . pendant 1837-40, sous . . . J. Dumont d'Urville.

Fishes, H. Jacquinot & A. Guichenot, 1853.1.

"Aurora." — [Die Reise [in Japan] S. M. Schiff "Aurora" in den Jahren 1895 und 1896.]

Fishes, F. Steindachner, 1896.2.

Australasian Antarctic. — Australasian Antarctic expedition, 1911-14, under . . . Sir Douglas Mawson.

Fishes, E. R. Waite, 1916.1, 2.

Baluchistan. — Die Reise von Dr. Eric Zugmayer in Balutschistan, 1911.

Fishes, E. Zugmayer, 1913.3.

"Beagle." — The voyage of H.M.S. "Beagle," [around the world] under . . . Capt. Fitzroy, during . . . 1832-36.

Fishes, L. Jenyns, 1842.1.

"Belgica" (Greenland). — La croisière océanographique de "La Belgica" dans la mer du Grönland, 1905.

Fishes, E. Koefoed, 1909.2.

"Belgica" (Antarctic). — Expédition antarctique belge . . . voyage du S.Y. "Belgica," 1897 à 1899.

Fishes, L. Dollo, 1900.1-1904.1. Comments on this expedition, W. H. Dall, 1905.1; J. W. G. 1906.1.

¹ A list of the chief voyages and expeditions known to us on which fishes have been collected in considerable numbers.

For a geographical arrangement comprising geographical works, narratives of travel, etc., see the section "Fauna of the World," of the Subject Index.

Titles are abbreviated or summarized. For full titles (so far as known to us), see in citation of author in footnote.

"Blake." — [Dredging in the Caribbean Sea and Gulf of Mexico and on the east coast of the U. S., 1878-80, in the U. S. Coast Survey steamer "Blake."]

Fishes, G. B. Goode & B. A. Bean, 1882.3, 1886.1, 1896.1.

Baltic Sea. — [The Russian expedition to the "Ostsee."]

Fishes, E. K. Suvorov, 1910.1, 1913.1.

"Blossom." — Capt. [F. W.] Beechey's voyage [in the ship "Blossom"] to the Pacific and Behring Straits in 1825-28.

Fishes, J. E. Gray, 1839.1; G. T. Lay & E. T. Bennett, 1839.1.

"Bonite." — Voyage autour du monde . . . pendant 1836 et 1837 sur . . . "La Bonite," commandée par M. Vaillant.

Fishes, A. Valenciennes, 1842.1. Comments on results, H. M. D. Blainville, 1838.1.

Borneo. — L'expédition scientifique néerlandaise au Bornéo central.

Fishes, L. L. Vaillant, 1902.1.

Cape Horn. — Mission scientifique du Cap Horn, 1882-83.

Fishes, L. L. Vaillant, 1888.3.

Castelnau. — Expédition dans les parties centrales de l'Amérique du Sud . . . pendant . . . 1843 à 1847.

Fishes, F. de Castelnau, 1855.1.

"Caudan." — La campagne du "Caudan" dans le golfe de Gascogne, août-septembre, 1895.

Fishes, R. Köhler, 1896.1.

"Challenger." — The voyage of H.M.S. "Challenger" [around the world] during 1873-76 under . . . Sir C. W. Thomson and J. Murray.

Fishes, A. Günther, 1877.6, 1878.3, 1880.5, 1887.5, 1889.8; H. N. Moseley, 1887.1; R. von Lendenfeld, 1887.2. Minor notes, narratives, etc., J. Murray, 1876.1; C. W. Thomson, 1877.1; W. J. Spry, 1876.1; R. von Willemoes-Suhm, 1875.1; H. N. Moseley, Add. 1876.1.

Charcot — L'expédition antarctique française (1903-05) commandée par Dr. Jean Charcot.

Fishes, L. L. Vaillant, 1906.1-1907.1.

"Chevert." — The "Chevert" expedition to New Guinea.

Fishes, H. G. Alleyne & W. M. Macleay, 1877.1.

"Coquille." — Voyage autour du monde . . . sur "La Coquille" pendant . . . 1822-25.

Fishes, R. P. Lesson, 1828.1, Add. 1830.1. Narrative, L. I. Duperry, 1826.1.

"Corsaro." — Crociera del "Corsaro" (alle Isole Madera e Canarie) del Capitano E. D'Albertis.

Fishes, D. Vinciguerra, 1883.1.

"Curaçoa." — Cruise of H. M. S. "Curaçoa" among the South Sea Islands in 1865.

Fishes, A. Günther, 1872.10, 1873.8. Narrative, J. L. Brenchley, 1873.1.

Danish Greenland. — Danmarks-Ekspeditionen til Grønlands nordostkyst, 1906-08.

Fishes, F. Johansen, 1906.1.

East Indies. — Voyage aux Indes Orientales . . . pendant, 1825-29, par Charles Bélanger.

Fishes, A. Valenciennes, 1834.1.

— Eine Reise in niederländisch Ost-Indien [1888-89].

Fishes, M. Weber, 1890.1.

Egypt. — L'expédition [en Egypte] de l'armée française [sous Napoléon Bonaparte], 1798-1801.

Fishes, E. Geoffroy-Saint-Hilaire, 1809.2; I. Geoffroy-Saint-Hilaire, 1827.1., 2.

"Endeavor" (Cook's First Voyage). — [An account of a voyage round the world, in the "Endeavor" in 1768-71.]

Fishes, D. C. Solander (ms.) 1768.1.

"Endeavor." — [Expedition of F. I. S. "Endeavor," 1909-10, in south Australian waters.]

Fishes, A. R. McCulloch, 1911.1, 1914.1, 1916.1.

"Erebus" and "Terror." — Voyage [into the Antarctic] of the "Erebus" and "Terror" under . . . Sir J. C. Ross during . . . 1839-43.

Fishes, J. Richardson & J. E. Gray, 1844.1.

"Fishhawk." — [Expeditions of the U. S. Fish Commission steamer "Fishhawk" in the northwest Atlantic.]

Fishes, G. B. Goode & B. A. Bean, 1896.1.

"Garland." — Trawling experiments of the "Garland" [Scottish Fisheries Board], 1889-1901.

Fishes, T. W. Fulton, 1890.5-1902.4; W. Wallace 1896.1. For trawling results etc., see Fishery Board for Scotland, under Fisheries, Scotland, in Index.

German East African. — Eine in . . . 1888-90 . . . von . . . F. Stuhlmann in die Küstengebiete von Ost-Afrika unternommenen Reise.

Fishes, G. Pfeffer, 1893.1., 2.

German Central African. — Die deutsche Zentral-Afrika Expedition, 1907–08.

Fishes, P. Pappenheim & G. A. Boulenger, 1914.1.

German East Asian. — Die preussische Expedition nach Ost-Asien [China, Japan, Borneo].

Fishes, E. von Martens, 1865.1, 1876.1.

German North Polar. — Die zweite deutsche Nordpolarfahrt in 1869 und 1870.

Fishes, W. C. H. Peters, 1874.1.

German South Polar. — Die deutsche Südpolar-Expedition, 1901–03.

Fishes, P. Pappenheim, 1912.1, 1914.1; L. Lampe, Add. 1914.1.

"Golden Crown." — Expeditions of the government of Bengal's steam trawler "Golden Crown" [in the Bay of Bengal].

Fishes, B. L. Chaudhuri, 1908.2; A. Ahmad, 1911.1; J. T. Jenkins, 1910.2–1912.1; N. Annandale, 1909.1, 1910.1; N. Annandale & J. T. Jenkins, 1910.1.

Gruvel. — Missions Gruvel sur la côte occidentale d'Afrique (1905–12).

Fishes, J. Pellegrin, 1914.2.

Hamburg Magellan. — Die Hamburgische magelhaenische Sammelreise, 1892–93.

Fishes, E. Lönnberg, 1907.1.

"Herald." — The voyage of H.M.S. "Herald" during . . . 1845–51 . . . around the globe and in the Arctic Ocean.

Fishes, J. Richardson, 1854.1.

"Hirondelle." — [Expeditions to the Azores and Canary Islands in 1885–88 by the Prince of Monaco in his yacht "Hirondelle."]

Fishes, R. Collett, 1889.1, 1896.2. Other accounts, under Albert I (Prince of Monaco).

"Hirondelle II." — Campagnes du yacht "Hirondelle II," 1911–13.

Fishes, E. Zugmayer, 1913.2, 1914.1.

Hopkins-Stanford. — The Hopkins-Stanford Galapagos Expedition, 1898–99.

Fishes, R. E. Snodgrass & E. Heller, 1903.1, 1905.1, 1906.1.

Howgate. — [The Howgate polar expedition to Arctic America, 1877–78.]

Fishes, T. H. Bean, 1879.1.

Indiana-Carnegie. — Expedition to British Guiana of Indiana University and the Carnegie Museum, 1908.

Fishes, C. H. Eigenmann, 1909.4, 1912.2.

Indo-China. — Mission Pavie Indo-Chine, 1879–95.

Fishes, L. L. Vaillant, 1892.2, 5, 1901.2.

"Ingolf." — Danske "Ingolf"-Expedition [to the north Atlantic].

Fishes, H. F. Jungersen, 1898.1, 1899.1, 1905.1; C. F. Lütken, 1898.1.

"Investigator." — [Cruises of H. M. Indian marine surveying steamer "Investigator" in the Bay of Bengal.]

Fishes, A. Alcock, 1889.1–1899.1, 1901.1–1905.1; A. Alcock & A. C. McGilchrist, 1892.1; A. F. McArdle, 1901.1; R. B. Seymour-Sewell, 1912.1, 1913.1.

"Lady Franklin" and "Sophia." — Voyage in Baffin's Bay and Barrow Straits in . . . 1850–51, performed by H.M.S. "Lady Franklin" and "Sophia."

Fishes, P. C. Sutherland, 1852.1.

"La Manche." — Voyage de "La Manche" à l'île Jan-Mayen et au Spitzberg, 1892.

Fishes, L. L. Vaillant, 1894.1.

"Magenta." — Viaggio . . . al globo della . . . "Magenta" durante . . . 1863–68.

Zoology, A. Targioni-Tozzetti, 1877.1.

Mexico and Central America. — Mission scientifique au Mexique et dans l'Amérique centrale.

Fishes, L. L. Vaillant & F. Boucourt, 1874.1.

"Michael Sars." — The "Michael Sars" north Atlantic deep sea expedition, 1910 . . . under Sir John Murray and Dr. Johann Hjort.

Fishes, E. Collett, 1909.1; E. Lea, Add 1913.1 (Muraenoid larvæ). Report on expedition, E. Lea, 1913.2.

Moluccas and Borneo. — Eine zoologische Forschungsreise in den Molukken und Borneo . . . von W. Kuken-thal.

Fishes, F. Steindachner, 1903.1.

New Guinea. — Nova Guinea . . . l'expédition . . . Néerlandaise à la Nouvelle-Guinée en 1903 [1907 et 1909] sous . . . Arthur Wichmann.

Fishes, M. Weber, 1908.1, 1913.3.

New Zealand. — New Zealand government trawling expedition, 1907.

Fishes, E. R. Waite, 1909.1.

Norwegian North Atlantic. — Den Norske Nordhavs-Expedition, 1876–78.

Fishes, R. Collett, 1878.1, 2, 1880.1, 4.

"Novara." — Reise der oesterreichischen Fregatte "Novara" um

die Erde, in . . . 1857-59, unter . . . Commodore B. von Wüllerstorff-Urbair.

Fishes, R. Kner, 1864.4, 1865.3. Narrative, etc., B. von Wüllerstorff-Urbair, 1861.1.

"Olga." — Eine Untersuchungs-fahrt [der "Olga,"] nach der Bäreninsel und Westspitzbergen [im Jahre 1898].

Fishes, E. Ehrenbaum, 1905.1.

Orbigny. — Voyage dans l'Amérique méridionale . . . pendant . . . 1826-33, par A. d'Orbigny.

Fishes, A. Valenciennes, 1847.2.

Peary. — Peary auxiliary expedition of 1894.

Fishes, O. Holmquist, 1899.1.

— Peary relief expedition of 1899.

Fishes, H. W. Fowler, Add. 1914.3.

Przewalski Central Asian. — Die von N. M. Przewalski nach Central-Asien unternommene Reise.

Fishes, S. M. Herzenstein, 1888.1.

"Princesse Alice." — [The explorations of Albert I of Monaco in the "Princesse Alice" in the Mediterranean Sea and the eastern Atlantic, 1901-10.]

Fishes, J. Richard, 1905.1; E. Zugmayer 1911.1, 2. Narrative, etc., Albert I (Prince of Monaco) 1896.1, 1904.1, 1906.1, Add. 1895.1

Princeton Patagonian. — The Princeton University expeditions to Patagonia, 1896-99.

Fishes, C. H. Eigenmann, 1909.3, 1910.1.

"Samarang." — The voyage of H.M.S. "Samarang" [in eastern seas], under . . . Captain E. Belcher, during 1843-46.

Fishes, J. Richardson, 1848.1. Smaller papers, A. Adams, 1850.1-1863.1, Add. 1864.1.

Schomburgk, (R. H.). — R[obert] H[ermann] Schomburgk's Reisen in Guiana und am Orinoko während . . . 1835-39.

Fishes, R. H. Schomburgk, 1841.1.

Schomburgk, (M. R.). — Reisen in Britisch-Guiana in . . . 1840-44 . . . von M[oritz] R[ichard] Schomburgk.

Fishes, J. Müller & F. H. Troschel, 1848.1.

"Scotia." — The Scottish National Antarctic Expedition [in the "Scotia"] . . . 1902-04 . . . under W. S. Bruce.

Fishes, R. S. Clark, 1912.1, 1913.1; L. Dollo, 1906.2-1909.3; C. T. Regan, 1913.1. Narrative, etc. T. Wilton, 1908.1; W. S. Bruce, Add. 1914.1.

Semon. — Zoologische Forschungs-reisen in Australien und dem malay-

ischen Archipel . . . 1891-93 von Dr. Richard Semon.

Fishes, R. W. Semon, 1893.1-1908.1; M. Weber, 1895.2. Narrative, R. W. Semon, 1896.2, 1899.1, 1903.2; W. B. Spencer, 1898.1.

"Siboga." — Siboga-Expeditie . . . in nederlandsch Oost-Indië, 1899-1900.

Fishes, M. Weber, 1909.1, 1913.1; narrative, 1901.2.

South Australian. — South Australian government trawling cruise, 1914.

Fishes, E. R. Waite & A. R. McCulloch, 1915.1.

"Southern Cross." — [Voyage of the "Southern Cross" into the Antarctic regions in 1908-09.]

Fishes, G. A. Boulenger, 1902.30.

Spix and Martius. — Reise in Brasilien . . . 1817 bis 1820 gemacht . . . von J. B. von Spix und C. F. P. von Martius.

Fishes, J. B. von Spix & L. Agassiz, 1829.1. Narrative, J. B. von Spix & C. F. P. von Martius, 1823.1, 1824.1.

Stanford. — The Stanford expedition to Brazil in 1911.

Fishes, E. C. Starks, 1913.1.

"Sulphur." — The . . . voyage of H. M. S. "Sulphur" [around the world] under . . . Capt. Sir Edward Belcher, during . . . 1836-42.

Fishes, J. Richardson, 1844.5.

Sunda. — Die Sunda-Expedition des Vereins für Geographie und Statistik zu Frankfurt-am-Main.

Fishes, C. M. Popta, 1912.2, 3.

Swedish Arctic. — The Swedish Arctic expedition to Spitzbergen and King Charles Land, 1898.

Fishes, E. Ehrenbaum, 1901.2; E. Lönnberg, 1899.5.

Swedish Magellan. — Die schwedische Expedition nach den Magellansländern, 1895-97.

Fishes, F. A. Smitt, 1897.1.

Swedish South Polar. — Die schwedische Südpolar Expedition, 1901-03, unter . . . Dr. O. Nordenskiöld.

Fishes, E. Lönnberg, 1905.3.

"Terra Nova." — British antarctic ("Terra Nova") expedition, 1910.

Fishes, C. T. Regan, 1914.1, 4, 1916.3.

Tanganyika. — [Expeditions to Lake Tanganyika — I, 1895-96; and

II, 1899-1900, by J. E. S. Moore: and III, 1904-1905, by W. A. Cunningham.]

Fishes, G. A. Boulenger, 1898.15, 1900.8, 1901.10, 23, 1906.6.

Thayer. — [The Thayer expedition to Brazil under Louis Agassiz, 1865-66.]

Fishes, C. H. Eigenmann, 1908.1. Narrative, Prof. L. and Mrs. E. C. Agassiz, 1868.1.

Prof. Eigenmann has issued several papers since 1914 on the fishes collected by this expedition.

"Thetis." — Trawling operations off the coast of New South Wales . . . by H.M.C.S. "Thetis."

Fishes, E. R. Waite, 1898.1, 2, 1899.4, 1900.3.

Tilho. — Mission Tilho [au Lac Tchad] (1906-09).

Fishes, J. Pellegrin, 1914.3.

"Travailleur" and "Talisman." — Expéditions scientifiques du "Travailleur" et du "Talisman" [autour du monde] pendant, 1880-83.

Fishes, L. L. Vaillant, 1888.2. General accounts, E. L. Bouvier, 1890.1; H. Filhol, 1884.1, 1885.1.

United States Naval. — The United States naval astronomical expedition to the southern hemisphere [Chile], during . . . 1849-52.

Fishes, C. Girard, 1855.1, 1856.1.

"Uranie" and "Physicienne" — Voyage autour du monde . . . sur "L'Uranie" et "La Physicienne," pendant, 1817-20.

Fishes, J. R. C. Quoy & P. Gaimard, 1824.1, 2, 3.

"Valdivia." — Die deutsche Tiefsee-Expedition auf dem . . . "Valdivia" 1898-99.

Fishes, A. Brauer, 1902.1-1908.1. General reports on results, C. Chun, 1897.2-1908.1.

"Vénus." — Voyage autour du monde sur la . . . "Vénus," pendant . . . 1836-39, commandée par A. du Petit-Thouars.

Fishes, A. Valenciennes, Add. 1855.1.

"Violante." — Le crociere del "Violante" [nel Mediterraneo].

Fishes, D. Vinciguerra, 1883.2.

Werner. — Zoologische Forschungsreise Dr. Franz Werner's nach dem ägyptischen Sudan und Nord-Uganda.

Fishes, F. Werner, 1906.1.

Wilkes. — United States exploring expedition into the South Seas, 1838-42 [under Capt. C. Wilkes].

Fishes of the Pacific slope of North America, L. Agassiz, 1855.1. Narrative, C. Wilkes, Add. 1845.1.

"Wodan." — [Expeditions of the "Wodan" in the North Sea, 1902-11.]

Fishes, H. C. Redeke, 1911.3.

"Woy Woy." — The expedition of the "Woy Woy" in the Tasman Sea.

Fishes, A. R. McCulloch, 1907.1.

Yarkand. — [The first Yarkand expedition of the government of India, 1873].

Fishes, F. Day, 1876.3.

— [Second Yarkand mission of the government of India.]

Fishes, F. Day, 1878.5.

VI

PERIODICALS RELATING TO FISH AND FISH-CULTURE, WITH THE ABBREVIATIONS HEREIN USED.¹

Aarsber. Vedkom. Norges Fiskerier. — Aarsberetning Vedkommende Norges Fiskerier. Christiana, 1882; Bergen, 1900. Current.

Abh. Deutsch. Seefischerei-Ver. — Abhandlungen des Deutschen Seefischerei-Vereins. Berlin, 1897-1913. Current (?).

Acquicolt. Lombard. — L'Acquicoltura Lombarda. Milano, 1899-1905. 7 vols.

Next as "Rev. Mens. Pesca," Milano. (q. v.).

Allg. Fisch.-Zeitg. — Allgemeine Fischerei-Zeitung. München, 1886 to date. Current.

Continuation of "Bayerische Fischerei-zeitg." (q. v.).

Amer. Angler. — The American Angler. New York, 1881-1900. 30 vols.

Merged in 1900 into "Field & Stream."

Amer. Fish Cult. — The American Fish Culturist. St. Johnsbury, Vt., 1904-05. 2 vols.

Merged with "Field & Stream," 1905.

Ann. Stat. Aquic. Boulogne-sur-Mer. — Annales de la Station Aquicole de Boulogne-sur-Mer. Boulogne-sur-Mer, 1892-1912. Ceased(?).

Ann. Rept. Comm. Fisheries of N. Y. — Annual Report of the Commissioners of Fisheries of the State of New York. 1869-94.

Title varies. Next as:

Ann. Rept. Comm. Fish. Game & Forests of N. Y. Annual Report of the Commissioners of Fisheries, Game and Forests of the State of New York. 1895-99. Next as:

Ann. Rept. Forest, Fish & Game Comm. of N. Y. — Annual Report of the Forest, Fish and Game Commission of the State of New York. 1900 to date. Current.

Ann. Rept. Comm. Fisheries Indiana. — Annual Report of the Commissioner of Fisheries of Indiana. 1882-83.

Afterwards "Bienn. Rept.," etc. (q. v.).

Ann. Rept. Comm. Inland Fisheries Rhode Island. — Annual Report of the Commissioners of Inland Fisheries of the State of Rhode Island. 1871 to date. Current.

Ann. Rept. Dept. Marine & Fisheries Canada. — Annual Report of the Department of Marine and Fisheries of Canada. 1868 to date. Current.

Ann. Rept. Fish. Board Scotland. — Annual Report of the Fishery Board for Scotland. 1882 to date. Current.

See also "Rept. Fishery Board Scotland. Sci. Invest.," and ditto, "Salmon Fisheries."

An. Com. Perm. Pesca. — Anuario Comision Permanente de Pesca. Madrid, 1868-69. 2 vols. All published.

Arbeit. Ichthyol. Lab. Kasp. Fisch.-Verwalt. — Arbeiten des Ichthyologischen Laboratorium der Kaspischen Volgaschen Fischerei-Verwaltung in Astrachan. (Text in Russian) 1909-13. Ceased (?).

Arch. Fischereigesch. — Archiv für Fischereigeschichte. Darstellungen und Quellen. Berlin, 1913-17. Current (?).

¹ A list of the chief periodicals on these subjects, with places and years of publication so far as ascertained. The articles ("a," "an," and "the") in English and other languages are disregarded in alphabetizing.

The abbreviations are placed first in order that this section may serve as a finding list for the full titles.

Bayerische Fischerei-Zeitg. — Bayerische Fischerei-Zeitung. München, 1879-85. 7 vols.

In 1885 name changed to "Allg. Fisch.-zeitg." (q. v.).

Bericht Fischerei-Ver. Prov. Ostpreuss. — Bericht des Fischerei-Vereins für die Provinz Ostpreussen. Königsberg, 1876 to date. Current.

Bienn. Rept. Comm. Fisheries California. — Biennial Report of the Commissioners of Fisheries of the State of California. 1870-84. Title varies.

Bienn. Rept. State Board Fish Comm. California. — Biennial Report of the State Board of Fish Commissioners for the State of California. 1885 to date. Current.

Bienn. Rept. Comm. Fisheries & Game Indiana. — Biennial Report of the Commissioner of Fisheries and Game of Indiana. 1884 to date. Current.

First as "Ann. Rept.," etc. (q. v.).

Bienn. Rept. State Board Fish. Comm. Michigan. — Biennial Report of the State Board of Fish Commissioners of Michigan. 1873 to date. Current.

Blätt. Aquar. Terrar. Freunde. — Blätter für Aquarien- und Terrarienfrende. Magdeburg, 1890-95.

Apparently changed title to:

Blätt. Aquar. Terrar. Kunde. — Blätter für Aquarien- und Terrarienkunde. Stuttgart, 1890-1914. Ceased (?).

Bohuslänsk Fiskerit. — Bohuslänsk Fiskeritidsskrift. Göteborg, 1884-96. 12 vols.

Boletin Bosques, Pesca i Caza. — Boletin de Bosques, Pesca i Caza. Santiago, Chile, 1912-15. Current (?).

Boll. Soc. Lombarda Pesca Acquicoltura. — Bolletino Mensile della Società Lombarda per la Pesca e l'Acquicoltura. Milano, 1908 to date. Current.

Bull. Ill. State Lab. Nat. Hist. — Bulletin of the Illinois State Laboratory of Natural History. 1884 to date. Current.

Bull. Mich. State Board Fish Comm. — Bulletin of the State Board of Fish Commissioners of Michigan.

Issued at irregular intervals with the "Bienn. Rept." (q. v.).

Bull. Pêches Marit. — Bulletin des Pêches Maritimes Annexe de la Revue Maritime et Coloniale. Paris, 1893-98. 6 vols.

Vol. I entitled "Revue Maritime et Coloniale. Section Pêches."

Bull. Piscicult. Prat. — Bulletin de Pisciculture Pratique. Paris, 1888-90. 3 vols.

Continued as "Etangs et Rivières." (q. v.).

Bull. Pop. Piscic. Amél. Pêche. — Bulletin Populaire de la Pisciculture et des Améliorations de la Pêche. Paris, 1907-14. Ceased (?).

Bull. Soc. Centr. Acquicult. Pêche. — Bulletin de la Société Centrale d'Acquiculture et de Pêche. Paris, 1888-1914. Ceased (?).

Bull. Soc. Imp. Zool. Acclimat. — Bulletin de la Société Impériale Zoologique d'Acclimatation de France. 1854-71.

Title varies. Next as:

Bull. Soc. Acclimat. — Bulletin de la Société d'Acclimatation de France. Paris, 1872-81. Finally as:

Bull. Soc. Nat. Acclimat. — Bulletin de la Société Nationale d'Acclimatation de France. Paris, 1882 to date. Current.

Bull. Station Piscicult. — Bulletin de la Station de Pisciculture et Hydrobiologie de l'Université de Toulouse. 1903-(?).

Bull. Suisse Pêche Piscicult. — Bulletin Suisse de Pêche et Pisciculture. Neuchâtel, 1900 to date. Current.

Bull. Trim. Enseign. Prof. Tech. Pêches Marit. — Bulletin Trimestriel de l'Enseignements Professionnels et Techniques de Pêches Maritimes. Paris, 1895-(?).

Bull. U. S. Fish Comm. — Bulletin of the United States Fish Commission. Washington, 1881-1903, vols. 1-23.

Beginning with 1904, title is:

Bull. [U. S.] Bur. Fisheries. — Bulletin of the [United States] Bureau of Fisheries. Washington, 1904, vol. 24, to date. Current.

Circul. Deutsch. Fischerei Ver. — Circulare des Deutschen Fischerei-Vereins. Berlin, 1871-92.

Conseil Perm. Intern. Explor. Mer. Rapp. & Proc. Ver. — Conseil

Permanent International pour l'Exploration de la Mer. Rapports et Procès-Verbaux des Réunions. 1902 to date. Current.

Copeia. (Not abbreviated.) New York, 1913 to date. Current.

Dansk Fiskerit. Dansk Fiskeritidende . . . Medlemsblad for Dansk Fiskeriforening. Kjøbenhavn, 1891-1918. Current.

Apparently began publication, Helsingør, 1891. Ny Raekke, Copenhagen, 1903-1918, vols. 1-15.

Deutsche Fischerei-Korresp. — Deutsche Fischerei-Korrespondenz. Köln (afterwards Bonn), 1897-1915. Ceased (?).

Deutsch. Fischerei-Zeitg. — Deutsche Fischerei-Zeitung. Wochenblatt für See- und Binnenfischerei, etc. Stettin, 1878 to date. Current.

Dneven. Otd. Icht. Imp. R. Obšč. Acclim. — Journal de la Section Ichthyologique de la Société Impériale Russe d'Acclimatation des Plantes et des Animaux. Moscou, 1883 (?)—(?).

Same as "Trd, Otd. Ichthiol. Obšč. Acclim." (q. v.).

Etangs et Rivières. (Not abbreviated). Paris, 1891-98. 8 vols.

Continuation of "Bull. Piscicult. Prat." (q. v.).

Ferskvandsfiskeribladet. — Ferskvandsfiskeribladet. Dansk Ferskvandsfiskeriforenings Medlemsblad. Kolding, 1906-1912. Current (?).

Field and Stream. (Not quoted by us.)

Formed by mergers of "Amer. Angler" and "Amer. Fish Cult." (q. v.).

Finlands Fiskerier. — (Not abbreviated.) Helsingfors, 1912 to date. Current.

Der Fischerbote. — Der Fischerbote. Zeitschrift für . . . Hochsee-Küsten- und Flussfischerei, etc. Hamburg, 1910 to date. Current.

Fischerei-Zeitg. — Fischerei-Zeitung. Wochenschrift für . . . Binnenfischerei, etc. Neudamm, 1898 to date. Current.

Fisheries Scotland Sci. Invest. — Fishery Board for Scotland. Scientific Investigations. 1909 to date. Current.

One of the subsidiary parts of the "Ann. Rept. Fish. Board Scotland." (q. v.).

Fish. Gazette. — Fishing Gazette, etc. London, 1865 to date. Current.

Fish. Ireland Scient. Invest. — Scientific Investigations. Part II of Report Sea and Inland Fisheries of Ireland. (q. v.).

Fiskeritidskr. Finland. — Fiskeritidskrift för Finland. Utgifna af Fiskeriförening. Helsingfors, 1892 to date. Current.

Forest & Stream. — (Not abbreviated.) New York, 1874 to date. Current.

Gyogaku Zasshi. — (Not abbreviated.) (Journal of Ichthyology.) 1914 to date. Current.

Intern. Rev. Ges. Hydrobiol. & Hydrog. — International Revue der Gesamten Hydrobiologie und Hydrographie. Leipzig, 1908 to date. Current.

Jahresber. Rhein. Fischerei-Ver. — Jahresbericht des Rheinischen Fischerei-Vereins. Bonn, 1888-1909.

Jahresb. Schles. Fischerei-Ver. — Jahresbericht des Schlessischen Fischerei-Vereins. Breslau, 1899(?)—1911(?) . . .

Journ. Imp. Fish. Bureau. — Journal of the Imperial Fisheries Bureau. Tokyo, 1892 to date(?). Current(?).

Nearly all articles in Japanese.

Journ. Nat. Fish Cult. Assoc. — Journal of the National Fish Culture Association. London, 1887. 2 vols.

Journ. Mar. Biol. Assoc. — Journal of the Marine Biological Association of the United Kingdom. Plymouth, 1887 to date. Current.

Korrespbl. Fischzucht. — Korrespondenzblatt für Fischzüchter. Berlin, 1893 to date. Current.

Meddel. Komm. Havundersørgelser. Ser. Fiskeri. — Meddelelser fra Kommission for Havundersørgelser. Series Fiskeri. Kjøbenhavn, 1904 to date. Current.

Meddel. Norske Jæger & Fisker. Forening. — Meddelelser fra Norske Jæger og Fisker-Forening. Kjøbenhavn, 1872-80. 9 vols.

Meded. Visch. — Mededeelingen over Vischerij. Helder, 1884 to date. Current.

Meded. Vischerijstation. — Mededeelingen van het Vischerij Station te Batavia. Buitenzorg, 1908 to date(?). Current(?).

Medlemsbl. Dansk Fiskeriforen. — Medlemsblad for Dansk Fiskeriforening. Copenhagen.

Secondary title for "Dansk Fiskerit." (q. v.).

Mitth. Deutsch. Seefischerei-Ver. — Mittheilungen des Deutschen Seefischerei-Vereins. Berlin, 1885 to date. Current.

Mitth. Fischerei-Ver. Prov. Brandenburg. — Mittheilungen des Fischerei-Vereins für die Provinz Brandenburg. Berlin, 1908-14. (Ceased?).

Mitth. Fischereiwesen. — Mittheilungen über Fischereiwesen. München, 1876-78. 3 vols.

Continued as "Bayerische Fischerei-Zeitg." 1879-85. (q. v.).

Mitth. Westpreussischen Fischerei-Ver. — Mittheilungen des Westpreussischen Fischerei-Vereins. Danzig, 1888 to date. Current.

Natur u. Haus. — Natur und Haus. Illustrierte Zeitschrift für alle Liebhaber im Reiche der Natur. Berlin, later Stuttgart, then Dresden, 1892 to date. Current.

Neptunia. — Neptunia. Revista Italiana di Pesca ed Agricoltura. Venezia, 1897 to date. Current. (2 vols. per year.)

Nordisk Aarsskr. Fiskeri. — Nordisk Aarsskrift for Fiskeri. Kjøbenhavn, 1884-87.

Continuation of "Nordisk Tidsskr. Fiskeri." (q. v.).

Norsk Fiskerit. — Norsk Fiskeritidende. Udgivet ved Selskabet for de Norske Fiskeriers Fremme. 1882 to date. Current.

Nordisk Tidsskr. Fiskeri. — Nordisk Tidsskrift for Fiskeri. Kjøbenhavn, 1874-83. 10 vols.

Continuation of "Tidsskr. Fiskeri" (q. v.), and in turn continued as "Nordisk Aarsskr. Fiskeri." (q. v.).

Oesterreich. Fisch.-Zeitg. — Oesterreichische Fischerei-Zeitung . . . Zeitschrift der K. K. Oesterreichischen Fischerei-Gesellschaft. Wien, 1904 to date. Current.

Pisciculture Pratique. — La Pisciculture Pratique. Bulletin des Sociétés de Pêche et de Pisciculture de France. Paris, 1897-1900. Ceased.

Proc. Amer. Fish Cult. Assoc. — Proceedings of the American Fish Culturists' Association. 1870-75.

Appeared next as "Trans.," etc. (q. v.).

Proc. Central Fishcult. Soc. — Proceedings of the Central Fishcultural Society. Chicago, 1879-80.

Ceased publication. Above reprinted from "Forest & Stream."

Proc. Trans. Liverpool Biol. Soc. — Proceedings and Transactions of the Liverpool Biological Society. 1886 to date. Current.

Rept. Comm. Fisheries Mass. — Report of the Commissioners of Fisheries of the Commonwealth of Massachusetts. 1867-70.

Title varies. Next as:

Rept. Comm. Inland Fisheries. Mass. — Report of the Commissioners of Inland Fisheries of . . . Massachusetts. 1871-86. Next as:

Rept. Comm. Inland Fisheries and Game Mass. — Report of the Commissioners of Inland Fisheries and Game of . . . Massachusetts. 1887-1902. Then as:

Rept. Comm. Fisheries & Game Mass. — Report of the Commissioners of Fisheries & Game of Massachusetts. 1903 to date. Current.

Rept. Fishery Board Scotland. Salmon Fisheries. — Report of the Fishery Board for Scotland. Salmon Fisheries. 1882 to date. Current.

One of the component parts of "Ann. Rept. Fish. Board Scotland." (q. v.).

Rept. Fisheries New South Wales. — Report of the Commissioners of Fisheries of New South Wales. 1879 to date. Current but irregular.

Rept. Danish Biol. Sta. — Report of the Danish Biological Station. Copenhagen, 1890 to date. Current.

Rept. Dove Marine Laby. — Report of the Dove Marine Laboratory, Cullercoats, Northumberland. 1912 to date. Current.

Succeeds "Rept. Northumberland Sea Fish. Comm." (q. v.).

Rept. Fishery Board Scotland. Sci. Invest. — Report Fishery Board for Scotland. Scientific Investigations. 1887 to date. Current.

One of the sections of "Ann. Rept. Fish. Board Scotland." (q. v.).

Rept. Imp. Fish. Bur. — Report of the Imperial Bureau of Fisheries. Tokyo, 1912 to date. Current.

Rept. Lancashire Sea-Fish. Labor. Reports of the Lancashire Sea-Fisheries Laboratory. Liverpool, 1893 to date. Current.

Rept. Sea Inland Fish. Ireland. — Report on the Sea and Inland Fisheries of Ireland. 1868 to date. Current.

Rept. Sea Inland Fish. Ireland. Sci. Invest. — Report of the Sea and Inland Fisheries of Ireland. Scientific Investigations. 1901 to date. Current.

One of the component parts of the preceding.

Rept. Northumberland Sea Fish. Comm. — Report on the Scientific Investigations, Northumberland Sea-Fisheries Committee. 1896-1911.

Succeeded by "Rept. Dove Marine Laby." (q. v.).

Rept. State Comm. Fisheries Pa. — Report of the State Commissioners of Fisheries of Pennsylvania. 1870-1902.

Title varies. Next as:

Rept. Dept. Fisheries Pennsylvania. — Report of the Department of Fisheries of the Commonwealth of Pennsylvania. 1903 to date. Current.

Rept. U. S. Fish Comm. — Report of the United States Commissioner of Fish and Fisheries. Washington, 1881-1903.

Title changed. Next as:

Rept. U. S. Comm. Fisheries. — Report of the Commissioner of [the U. S. Bureau of] Fisheries. Washington, 1904 to date. Current.

Rev. Intern. Pêche Piscicult. — Revue Internationale de Pêche et de Pisciculture. Société Impériale Russe de Pêche et Pisciculture. St. Petersburg, 1899-(?).

Rev. Mens. Pesca. — Revista Mensile di Pesca. Milano, 1898(?) — 1911. Ceased(?).

Successor to "Acquicolt. Lombard.," 1906. (q. v.).

Rev. Mens. Pesca Idrobiol. — Revista Mensile di Pesca e Idrobiologia. Pavia, 1895-1917.

Schweiz. Fisch.-Zeitg. — Schweizerische Fischerei-Zeitung. Zurich, 1892 to date. Current.

Skrift. Udgivn. Komm. Havundersøgelser. — Skrifter Udgivna af Kommissionen for Havundersøgelser. Kjøbenhavn, 1903 to date. Current.

Skrift. Södra Sveriges Fiskerifören. — Skrifter Utgivna av Södra Sveriges Fiskeriförening. 1906(?) to date(?). Current(?).

Soc. Imp. Russe Pêche Piscicult. — Société Impériale Russe de Pêche et Pisciculture. St. Petersburg, 1899-(?).

See also under "Rev. Intern. Pêche Piscicult."

Svensk Fiskeritidsskr. — Svensk Fiskeritidsskrift. Stockholm, 1892 to date. Current.

Tidsskr. Fiskeri. — Tidsskrift for Fiskeri. Kjøbenhavn, 1866-73. 7 vols.

Continued as "Nordisk Tidsskrift for Fiskeri." (q. v.).

Tidsskr. Jägare & Fisk. — Tidsskrift för Jägare och Fiskare. Helsingfors, 1893-1914. Current(?).

Trans. Amer. Fish Cult. Assoc. — Transactions of the American Fish Cultural Association. 1876-84.

First appearing as "Proc.," etc. (q. v.); next as:

Trans. Amer. Fisheries Soc. — Transactions of the American Fisheries Society. 1885 to date. Current.

For earlier parts, see under "Trans. Amer. Fish. Cult. Assoc.," and "Proc. Amer. Fish. Cult. Assoc."

Trans. Pacific Fisheries Soc. — Transactions of the Pacific Fisheries Society. 1914-15. 2 vols. All published.

Trd. Otd. Ichthiol. Obsč. Akklim. — "Trudy" (Trudui) of the Ichthyological Section of the Imperial Russian Society of Animal and Plant Acclimatization. [Text in Russian] Moskva, 1883-(?).

See also "Dneven. Otd. Icht. Imp. R. Obsč. Akclim."

Verhand. Rapp. Rijksinstit. Vischerionderzoek. — Verhandelingen en Rapporten uitgeven door de Rijksinstituten voor vischerionderzoek. 's Gravenhage, 1913 to date. Current.

Verh. Rijksinstit. Onderz. Zee. — Verhandeling uit het Rijksinstituut voor het Onderzoek der Zee. Helder, 1906. Irregular, but probably current.

Vischereijcourant. — Nederlandsche Vischereijcourant. Haarlem, 1902-1905. 3 vols.

Wiss. Meeresuntersuch. — Wissenschaftliche Meeresuntersuchungen. Kiel, 1894 to date. Current.

Wochenschr. Aquar. Terrar. Kunde. — Wochenschrift für Aquarien- und Terrarienkunde. Braunschweig, 1903 to date. Current.

Zeitschr. Akklimat. — Zeitschrift für Acclimatization. Berlin, 1858-74.

Zeitschr. Fisch. Hilfsw. — Zeitschrift für Fischerei und deren Hilfswissenschaften. Berlin, 1893 to date. Current.

VII

ERRATA AND CORRIGENDA¹

A., H. 1883.1, p. 1, correctly cited as H., A. 1883.1, p. 530.

Abt, F. N. 1789.1, p. 3, correctly cited as Ahl, J. N. 1789.1, p. 14.

Agassiz, A. 1865.1, 2, 3, p. 6, correctly cited under Agassiz, J. L. 1865.2, p. 13; — 1872.1, p. 6, correctly cited as Agassiz, J. L. 1871.1, p. 13.

Agassiz, J. L. 1835.3, p. 8, included in 1834.3; — 1835.4, p. 8, included in 1834.1; — 1840.2, p. 8, included in 1840.4; — 1844.4, p. 8, included in 1843.2; — 1844.10, p. 9, included in 1843.2; — 1856.6, p. 12, correctly cited as 1856.11; — 1858.6, p. 12, correctly cited as 1858.8; — 1858.10, p. 12, correctly cited as 1858.9.

Anderson, R. J. 1904.1, p. 26, not on fishes.

Antwerp, W. van, 1883.1, p. 30, better cited as Van Antwerp, W. 1883.1, vol. II, p. 577.

Arendsen Hein, S. A. 1913.1, p. 32, better cited as Hein, S. S. A. 1913.2, p. 559.

Artaud, J. B. L. 1821.1, p. 37 (second entry), same as 1821.1 preceding or first entry.

Aukarsvård, G. & Hammer, J. Aug. 1913.1, p. 43, correctly cited as Ankarsvård, G. & Hammar, J. A. 1913.1, p. 29.

B. 1895.1, p. 47, correctly cited as **Benecke, B.** 1895.1, p. 97.

B., B. 1877.1, p. 47, correctly cited under Bocage, J. V. 1878.1, p. 140.

Bacounin, —, 1789.1, p. 48, not a fish.

Baldaque da Silva, A. 1891.1, p. 61, better cited as Silva, A. B. da., 1892.1, vol. II, p. 449.

Balfour, F. M. 1878.2, p. 61, correctly cited as Balfour, F. M. 1876.2, p. 61.

Balfour, W. 1852.1, 2, 1853.1, p. 62, correctly cited as Baikie, W. B(alfour) Add. 1852.1, 2, 1853.1.

Baluchin, —, 1877.1, p. 65, correctly cited as Babukin, A. I. 1877.1, p. 48.

Bataillon, E. 1893.1, p. 73, correctly cited as Bataillon, E. & Dubard, —. 1895.1, p. 74.

Bayliss, W. M. & Staring, E. H. 1903.1, p. 78, contains no fishes.

Bean, B. A. 1908.1, p. 80, correctly cited as Bean, B. A. Add. 1899.1.

Bean, T. H. 1905.1, p. 87, correctly cited as Bean, T. H. 1903.1, p. 87.

Beaufort, L. de, 1912.2, p. 91, correctly cited as Weber, M. & Beaufort, L. de, 1912.3, vol. II, p. 610.

Beecher, C. E. 1898.1, p. 93, contains no fishes.

Beguis, J. M. 1882.1, p. 93, correctly cited as Reguis, J. F. 1882.1, vol. II, p. 327.

Belotti, C. 1890.1, p. 96, not a fish.

Bender, O. 1910.1, p. 96, not on fishes.

Berg, L. S. 1908.1, p. 102, probably same as Berg, L. S. & Kouznetzoff, I. D. 1908.1, p. 104; — 1913.9, p. 104, correctly cited as Berg, L. S. 1912.5, p. 103.

Bernard de Reste, C. 1791.1, p. 105, preferably cited as Reste, B. de, 1801.1, vol. II, p. 336.

Binney, W. G. 1842.1, p. 112, correctly cited as Binney, A. 1842.1, p. 112.

Bishop, Harman N. 1899.1, p. 113, correctly cited as Harman, B(ishop) N. 1899.1, p. 543.

Bleeker, P. 1857.11, p. 125, correctly cited as Bleeker, P. 1854.14, p. 122.

Bohn, G. 1907.1, p. 145, not on fishes.

Boll, E. 1858.1, p. 147, correctly cited as Boll, E. F. Add. 1868.1.

Bonaparte, C. L. 1833.1, p. 148, correctly cited as Bonaparte, C. L. Add. 1833.1.

Books, St. John, 1893.1, p. 151, correctly cited as Brooks, H. St. John, 1885.1, p. 187.

Bothe, A. 1899.1, p. 158, correctly cited as Bethe, A. 1899.1, p. 108.

Bottemanne, C. J. & Hock, P. P.

¹ In order to correct the errors in the preceding parts of this Bibliography, these authors or titles, unless corrections are here indicated, should be deleted.
Where no author is named in giving the correct citation, the original author is understood.
For an explanation of the principles involved in the compilation of this section, see the preface.

1888.1, p. 158, correctly cited as Hoek, P. P. & Bottemanne, C. J. 1888.1, p. 588.

Boudouy, T., p. 159, should be Bondouy, T., p. 149. The name of this author prefixed to his articles has appeared both as *Boudouy* and *Bondouy*, the latter, however, is correct.

Boulenger, E. G. 1913.1, p. 159, correctly cited as Boulenger, C. L. 1913.1, p. 159.

Boulenger, G. A. 1897.11, p. 162, correctly cited as 1898.12, p. 162; — 1898.6, p. 162, same as 1902.19, p. 166; — 1898.10, p. 162, included in 1895.8, p. 161; — 1900.16, p. 164, same as 1899.11, p. 163; — 1902.13, p. 166, correctly cited as 1901.8, p. 164; — 1912.3, p. 170, correctly cited as 1912.4, p. 170.

Bourne, R. H. 1898.1, p. 172, correctly cited as Burne, R. H. 1898.1, p. 204.

Boutan, L. & Racovitza, E. P. 1895.1, p. 172, not on fishes.

Branca, H. W. 1908.1, p. 175, not on fishes.

Breschet, G. & Becquerel, A. C. 1836.2, p. 180, not on fishes.

Brion, C. 1866.1, p. 183, correctly cited as Cicile-Brion, —, 1866.1, p. 236.

Browntree, Walter S. 1903.1, p. 190, correctly cited as Rowntree, W. S. 1903.1, vol. II, p. 367.

Burckhardt, C. R. 1893.1, p. 202, correctly cited as Burckhardt, C. R. 1894.2, p. 202.

Burgerstein, A. 1897.1, p. 203, not on fishes.

Cairncross, D. 1862.1, p. 208, not on fishes.

Campanyo, L. 1861.1, p. 211, correctly cited as Companyo, L. 1863.1, p. 258.

Carrigan, —, 1860.1, p. 219, correctly cited as Corrigan, D. J. 1860.1, p. 271.

Cerrigan, D. 1859.1, p. 226, correctly cited as Corrigan, D. J. 1863.1, p. 271.

Checcia-Rispoli, G. 1905.1, p. 230, not on fishes.

Clarke, W. Branwhite, 1838.1, p. 241, correctly cited as Clarke, William Barnard, 1838.1, p. 241.

Clark, W. G. 1898.1, p. 241, correctly cited as Clark, W. J. 1898.1, p. 241.

Cleef, J. S. van, 1885.1, p. 243, better cited as Van Cleef, J. S. 1886.1, vol. II, p. 577.

Clift, (Rev.) William, 1874.3, p. 244, correctly cited as Clift, M. 1874.1, p. 244.

Collett, R. 1876.1, p. 253, correctly cited as Collett, R. 1875.2, p. 253.

Cope, E. D. 1871.16, p. 261, correctly cited as 1870.6, p. 260; — 1882.1, p. 264, not on fishes; — 1892.4, p. 266, correctly cited as Eigenmann, C. H. & Eigenmann, R. S. 1892.3, p. 366.

Costa, O. G., p. 272, 1840.1, correctly cited as 1829.1; — 1849.1, correctly cited as 1846.1; — 1855.1, correctly cited as 1857.1, which should have date of publication read 1855 (Memorie).

Coste, P. 1867.1, p. 274, correctly cited as Coste, J. J. 1867.1, p. 273.

Couch, J. 1849.1, p. 275, correctly cited as Couch, J. 1842.1, p. 275.

Couch, R. Q. 1844.1, p. 276, correctly cited as Couch, J. 1844.2, p. 275.

Crispo-Barbaro, G. 1877.1, p. 280, better cited as Barbaro, G. C[rispo]. 1869.1, p. 65.

Dahl, K. 1906.4, p. 290, correctly cited as Dahl, K. & Dannevig, G. 1906.1, p. 291.

Dahlgren, U. 1898.2, p. 291, delete citation from Journ. Morphol. 1898, vol. 14, 117–124.

Day, F. 1884.3, p. 306, same as Day, F. 1884.2, p. 306.

Dean, B. 1893.5, p. 308, citation was published in Trans. N. Y. Acad. Sci., vol. 12, pp. 70–71.

Dekay, J. E., p. 314, should be written De Kay, J. E.

Delage, M. Y. 1887.1, p. 314, not on fishes.

Deslongchamps, J. A. E. 1831.1, p. 320, not on fishes.

Deynoot, W. T. G. 1829.1, p. 322, better cited as Gevers Deynoot, W. T. 1829.1, p. 454.

Dezsö, Bela von, p. 323, correctly cited as Desco, Bela von, p. 319.

Dixon, B. I. 1913.1, p. 325, should be written Dikson, B.

Dubois, Emil. This author and the following citations on p. 334 should be deleted. 1843.1, correctly cited under Du Bois-Reymond, E. H. Add. 1843.1, vol. III, p. 50; — 1843.2, correctly cited under Du Bois-Reymond, E. H. 1843.1, vol. I, p. 335.

Edwards, H. M. & Coste, —, 1850.1, p. 355, correctly cited as Milne-Edwards, A. & Coste, J. 1850.1, vol. II, p. 140.

Eigenmann, C. H. 1893.2, p. 362, same as 1892.3, p. 362; — 1893.3, p. 362, same as 1892.6, p. 362; — 1902.5, p. 363, same as 1903.3, p. 363; — 1904.1, p. 364, same as 1903.3, p. 363; — 1889.1, p. 361, correctly cited as

Eigenmann, C. H.

Eigenmann, C. H. & Eigenmann, R. S. 1889.5, p. 366.

Ellis, M. M. 1907.1, p. 369, not on fishes.

Ewart, J. C. 1893.3, p. 384, same as Ewart, J. C. 1892.1, p. 384.

Fargioni Tozzetti, A. 1880.1, p. 390, correctly cited as Targioni-Tozzetti, A. 1880.1, vol. II, p. 530.

Favrau, G. P. 1909.1, p. 393, correctly cited as Farran, G. P. 1909.1, p. 390.

Forbes, S. A., p. 406, 1903.1, included in 1880.1, p. 405; — 1903.2, included in 1800.3, p. 405.

Fortuyn, A. B. *Drooglever*, p. 409, these citations are properly included under Drooglever Fortuyn, A. B., p. 333.

Fourcroy, A. F. & Vauquelin, L. N. 1804.1, p. 409, not on fishes.

Franciscus, Erasmus. 1762.1, p. 414, correctly cited as Franciscus, Erasmus. Pre-Linn. 1668.1.

Fritsch, A. J. 1878.2, p. 422, same as Fritsch, G. T. 1878.1, p. 422.

Fritsch, G. T. 1886.2, p. 423, correctly cited as Fritsch, G. T. 1884.1, p. 423.

Fuchs, H. 1910.1, p. 425, not on fishes.

Fürbringer, M. 1875.1, p. 426, correctly cited as Fürbringer, P. 1875.1, p. 426.

Fuhrmann, O., p. 427, 1905.3, same as 1905.6; — 1906.3, same as 1905.1.

Fullarton, J. H. 1895.1, p. 428, not on fishes.

Fulton, T. W. 1892.3, p. 429, same as 1891.5, p. 429; — 1904.3, p. 431, same as 1904.5, p. 431.

Gage, S. H. 1893.1, p. 435, correctly cited as Gage, S. P. Add. 1893.1.

Gambel, W. 1850.1, p. 436, not on fishes.

Gargiulo, A. 1903.1, p. 437, correctly cited as Cargiulo, A. 1904.1, p. 217.

Garnault, P. 1888.1, p. 439, not on fishes.

Gegenbaur, C. 1869.1, p. 444, same as Gegenbaur, C. 1870.3, p. 445.

Gent, J. J. 1873.1, p. 448, correctly cited as Josselyn, J. Pre-Linn. 1672.1.

Geoffroy-Saint-Hilaire, E. F. 1818.1, p. 450, correctly cited under this author as 1807.8, p. 449. For other corrections see this author in Addendum, vol. III, p. 70.

Geusch, H. 1882.1, p. 454, correctly cited as Gensch, H. 1881.1, p. 448.

Gilbert, J. Z. 1888.1, p. 461, not on fishes.

Gill, T. N., p. 462, 1853.1, correctly cited as 1858.2; — 1853.2, correctly cited as 1858.3; — 1853.3, correctly cited as 1858.4; — 1853.4, correctly cited as 1858.5; — 1860.7, p. 463, contains no fishes.

Girard, C. F. 1853.1, p. 475, for correct citation see Baird, S. F. & Girard, C. 1853.2, p. 59; — 1853.2, p. 475, see Baird & Girard, 1853.3, p. 59; — 1854.1, p. 475, see Baird & Girard, 1853.1, p. 59; — 1854.2, p. 475, see Baird & Girard, 1854.1, p. 60; — 1854.3, p. 475, see Baird & Girard, Add. 1854.1.

Glaser, O. C. 1907.1, p. 478, not on fishes.

Glover, T. 1836.1, p. 479, correctly cited as Glover, T. Pre-Linn. 1676.1.

God, Arthur. 1902.1, p. 480, correctly cited as Good, Arthur. 1902.1, p. 484.

Goode, G. B. 1879.11, p. 486, correctly cited as Goode, G. B. & Bean, T. H. 1879.12, p. 490; — 1881.3, p. 487, same as 1880.10, p. 486.

Goode, G. B. & Collins, J. W. 1882.1, p. 491, same as Goode, G. B. & Collins, J. W. 1887.5, p. 491.

Gray, G. R. 1850.1, p. 499, correctly cited as Gray, J. E. 1850.1, p. 500.

Gray, J. E. 1825.1, p. 500, not on fishes.

Gregory, W. K. & Adams, L. A. 1914.1, p. 505. This article is by Gregory, W. K. alone.

Günther, A. C. 1880.3, p. 520, correctly cited as 1875.2, p. 519; — 1889.7, p. 521, same as 1889.3, p. 521.

Hall-Hünigen, (Director) 1894.1, p. 537, correctly cited as Haack, H. 1894.1, p. 532. Probably Director Haack of Hünigen.

Hamilton, A. 1902.2, p. 539, same as Hamilton, A. 1902.3, p. 539.

Hansen, V. 1883.1, p. 542, correctly cited as Hensen, V. A. 1883.1, p. 564.

Hardesty, I. 1908.1, p. 542, not on fishes.

Hay, O. P. 1899.4 and 1899.5, p. 554, not on fishes.

Helbing, H. 1902.1, p. 561, delete reference to Nova Acta Acad. Leopold. Correctly cited in 1904.1.

Herman, L. 1894.1, p. 569, not on fishes.

Heyke, D. 1744.1, p. 576, correctly cited as Heyke, D. Pre-Linn. 1744.2.

Hogg, J. 1858.1, p. 593, same as Hogg, J. 1854.1, p. 592.

Hohner, G. M. 1903.1, p. 593, correctly cited as Holmes, G. M. 1903.1, p. 597.

Holberg, L. 1819.1, p. 593, correctly cited as Hollberg, L. 1819.1, p. 596.

Hollard, H. L. 1864.2, p. 596, not on fishes.

Holmgren, A. E. 1894.1, p. 597, not on fishes.

Homburger, R. 1904.1, p. 601, correctly cited as Hamburger, R. 1904.1, p. 538.

Horsfield, T. 1821.1, p. 604, not on fishes.

Houssay, F. 1901.1, p. 605, not on fishes.

Imbert, A. 1909.1, p. 619, properly cited under Borc  a, J. 1909.3, p. 152.

Inge, M. 1899.1, p. 619, correctly cited as Juge, M. 1899.1, p. 664.

Jaekel, O. M. 1898.3, p. 626, correctly cited as Jaekel, O. M. 1898.1, p. 625.

Jardine, (Sir) W., p. 630, — "Fishes of Guiana," correctly credited to Schomburgk, R. H. 1841.1, p. 417.

Johnstone, J. 1905.1, p. 639, included in 1904.1; — 1912.1, p. 640, included in 1909.2.

Jordan, D. S. 1878.12, p. 644, same as 1877.1 (iiiB), p. 644; — 1909.1, p. 650, correctly cited as Jordan, D. S. & Evermann, B. W. 1909.1, p. 652.

Kaup, J. J. 1834.1, p. 672, correctly entered under S. —, Add. 1834.1, p. 166.

Keferstein, W. M. & Kupffer, C. 1857.1 and 1858.1, p. 674, correctly cited under Kupffer, C. & Keferstein, W. 1857.1, and 1858.1, p. 716.

Kendall, W. C. & Radcliffe, L. 1912.1, p. 677, should read vol. 35, not 25.

Klein, E. E., pp. 687 and 688, all citations, save 1872.1 and 1876.1, should be credited to Klein, A. von; 1884.1 is already so credited.

K  lliker, R. A. 1859.1 and 1859.2, p. 700, correctly cited under K  lliker, R. A. 1857.3, p. 699.

Kreyenberg, M., p. 710, 1911.3, same as 1911.1; — 1910.1, correctly cited as Kreyenberg, M. & Pappenheim, P. 1908.1.

Krukenberg, C. F. 1887.1, p. 712, contains no fishes.

La Blanch  re, P. R. 1878.1, p. 2, correctly cited as La Blanch  re, P. R. 1876.2, p. 2.

La Chapelle, — de, 1820.1, p. 3, correctly cited as Chapelle, — de la, Pre-Linn. 1733.1.

Lahille, F. 1913.3, p. 6, should read "Arica" not "Africa."

Le Boux, M. 1887.1, p. 20, correctly cited as Le Roux, M. 1887.1, p. 35.

Leiper, R. T. 1908.1, p. 27, not on fishes.

Leuckart, C. G. 1860.1, p. 38, not on fishes.

Leydig, F. 1909.1, p. 42, should read 1902.1.

Link, H. F. 1790.1, p. 46, correctly cited as Linck, H. F. Add. 1789.1.

Loewe, Fr. 1896.1, p. 59, year of publication should be 1904 and reference number 1904.1.

Lowe, R. T. 1840.3, p. 64, included in 1840.1; — 1854.1, p. 65, correctly cited under Brandt, J. F. & Lowe, R. T. 1854.1, p. 176, vol. I.

L  tken, C. F. 1871.1, p. 68, included in 1869.1; — 1875.2, p. 69, correctly cited as 1880.5, p. 70.

Lyngbye, H. C. 1826.1, p. 75, not on fishes.

MacCallum, G. A. 1913.1, p. 77, correctly cited as MacCallum, G. A. & MacCallum, W. G. Add. 1913.1.

M'Clelland, J. 1842.2, p. 78, included in M'Clelland, J. 1842.3.

MacCulloch, J. 1824.2, p. 80, same as MacCulloch, J. 1823.1.

McGovern, H. D., p. 83, 1879.1, not on fishes.

Macks, J. A., p. 89, should be written Op de Macks, J. A.

Maitland, J. R. Gibson, vol. II, p. 94, better cited as Gibson-Maitland, J. R. vol. I, p. 457.

Mangoldt, E., p. 98, should be written Mangold, E.

Marsh, M. C. & Gorham, F. P. 1906.1, p. 105, should be Marsh, M. C. (Sole author).

Mayer, A. F. 1862.2, p. 119, correctly cited as Mayer, A. F. 1862.1.

Meyer, —, 1872.1, p. 132, correctly cited as Meyer, R. 1872.1, p. 135.

M  bius, K. A. 1871.2, p. 146, not on fishes.

Modoerin, A. 1885.1, p. 146, better cited under Mad  rin, A. 1885.1, p. 91.

Mondini, C. 1783.1, p. 150, correctly cited as Mundini, C. Add. 1783.1.

Montgomery-Vignal, M. W., p. 151, is more correctly written Vignal, W. V. M(ontgomery), p. 584.

Morton, Allport. 1878.1, p. 158, correctly cited as Allport, M. 1878.1, vol. I, p. 23; — 1893.1–1897.1, p. 158, should read Morton, Alexander.

Moulder, E. 1861.1, p. 160, correctly cited as Mulder, E. 1861.1, p. 167.

Müller, J. 1835.1, p. 163, correctly cited as Eschricht, D. F. & Müller, J. 1835.2, vol. I, p. 375.

Müller, J. & Eschricht, D. F. 1835.1, p. 165, correctly cited as Eschricht, D. F. & Müller, J. 1835.1, vol. I, p. 375.

Müller, W. 1897.1, p. 166, correctly cited under Müller, F. W. 1897.1, p. 162.

Nardo, G. D. 1844.3, p. 173, date under second reference should be changed to 1853. See Nardo, G. D. 1853.1.

Newbold, T. J. 1849.1, p. 181, correctly cited as Newman, Edward. Add. 1849.1.

Nikolskii, A. M., p. 180, 1900.3, included in 1899.1; — 1902.2, same as 1902.1; — 1903.1, same as 1903.3; — 1904.1, same as 1903.2.

Nordqvist, O. F., p. 195, 1892.8, 1894.8, 1894.10, not on fishes; — citations 1908.2, 1911.1, 1912.1, 1913.1, 1914.1, p. 198, under this author, should properly be credited to Nordqvist, Harald.

Norny, E. R. 1885.1, p. 199, correctly cited as Norny, E. R. Add. 1885.1.

Ogilby, J. D. 1885.5, p. 207, same as Ogilby, J. D. 1885.6.

Oshima, K. 1911.1, p. 217, correctly cited as Ohshima, K. 1911.1, p. 209.

Otto, H. 1908.1, p. 219, not on fishes.

Paton, D. N. & others. 1898.1, p. 236, correctly cited as Paton, D. N. 1898.1, p. 236.

Pellegrin, J. 1904.2, p. 244, year of publication in citation should read 1903; — 1907.9, p. 245, and 1909.8, p. 246, correctly cited as 1908.6, p. 246; — 1910.1, p. 247, should read 1909; — 1911.5, p. 247, included in 1912.5, p. 248.

Peltzam, E. D. p. 249, should be written Pel'tzam, E. D.

Perengia, A. 1879.1, p. 250, correctly cited as Perugia, A. 1880.1, p. 253.

Petersen, C. G. J. 1902.1, p. 257, included in Petersen, C. G. J. 1902.4.

Peyrl, Theodor. 1910.1, p. 260, probably same author as Peyerl, Theodor. 1916.1, p. 260.

Pietschmann, V. 1907.1, p. 267, should have the following part of the title deleted, "Zwei stark variante Exemplare von Antennarius, etc."

This is properly recorded under Piet-schmann, V. 1909.2, p. 268; — 1908.2, p. 267, should be deleted. Same as 1907.1.

Platner, G. 1888.1, p. 271, contains no fishes.

Preyer, C. 1876.1, p. 285, correctly cited as Peyrer, C. 1876.1, p. 260.

Priem, F. 1907.4, p. 287, same as Priem, F. 1907.2, p. 286.

Priesbergen, F. 1886.1, p. 287, correctly cited as Piesbergen, F. 1886.1, p. 267.

Putnam, F. W., p. 292, 1865.3, correctly cited under 1865.5; — 1865.6, correctly cited under 1866.1; — 1865.7, correctly cited under 1865.1; — 1866.6, correctly cited under Add. 1865.1; — 1870.6, correctly cited under 1870.3.

Pylaie, — de la, 1834.1, p. 294 better cited as De la Pylaie, —, 1835.1, p. 315, vol. I.

Regan, C. T. 1909.12, p. 322, same as Regan, C. T. 1909.9, p. 322.

Reguart, A. S. 1791.1, p. 326, better cited as Sañez Reguart, A. 1791.1, p. 385.

Rivière, E. 1887.1, p. 351, correct year of publication is 1886.

Robin, A. 1883.1, p. 352, correctly cited as Robin, C. P. 1883.1, p. 352.

Rockwell, A. P. 1876.1, p. 354, correctly cited as Rockwood, A. P. 1876.1, p. 354.

Röse, C. 1889.1, p. 355, year of publication should be 1890; — 1890.1, p. 355, same as Röse, C. 1889.1.

Rose, V. 1805.1, p. 361, not on fishes.

Roselli, G. 1823.1, p. 361, not on fishes.

Ryder, J. A., p. 373, 1886.4, correctly cited as 1886.8; — 1886.5, same as 1885.6.

St. Sihleanu, S. 1876.1, p. 380, better cited as Sihleanu, S. 1876.1, p. 449.

Sanctis, Leone de, 1881.1, p. 382, not on fishes.

Sanderson, J. S. B. 1881.1, p. 383, contains no fishes.

Sandman, J. A. 1906.2, p. 385, same as Sandman, J. A. 1906.6.

Sauvage, H. E. 1888.7, p. 393, correctly cited as Sauvage, H. E. 1880.8, p. 392.

Sawadsky, A. M., p. 395, same author as Zavadskii, A. M., p. 668.

Schmidt, E. J., p. 406, 1906.4, included in 1905.1; — 1908.1, included in 1907.1, and 1907.2.

Schneider, G. 1900.5, p. 410; — 1903.8, 1904.15, p. 411; — 1906.4, 1907.2, p. 412, contain no fishes; —

1904.17, p. 411, same as 1903.13, p. 411; — 1908.5, p. 413, same as 1907.4, p. 412.

Schoenlein, K. & Willem, V. 1895.1, p. 416, same as Schoenlein, K. 1895.1, p. 416.

Schomburgk, (Sir) Robert Hermann, 1847.1, p. 417, for correct citation see Schomburgk, Richard. Add. 1847.1.

Schultze, M. J. S. 1864.1, p. 424, not on fishes.

Sebatier, A., p. 433, correctly cited as Sabatier, C. P. 1896.2, p. 376.

Seidlitz, G. 1877.1, p. 434, correctly cited as Seidlitz, G. 1882.1, p. 435.

Selaputin, G., p. 435, better cited as Schelaputin, Gr., p. 399.

Seelig, F. W. 1897.1, p. 434, in place of vol. 61, substitute vol. 42.

Sellig, F. W. 1897.1, p. 436, correctly cited as Seelig, F. W. 1897.2, p. 434.

Semon, R. W. & Spengel, J. W. 1897.1, p. 438, should be Semon, R. W. (Sole author).

Sichleanu, S. 1876.1, p. 447, correctly cited as Joliet, L. Add. 1876.1. The original citation is Sihleanu, S. 1876.1.

Siebold, C. T. 1847.1, p. 448, same as Siebold, C. T. 1863.2, p. 448.

Sjöberg, H. R. A. 1900.2, p. 452, not on fishes.

Solotnizky, N. F. p. 468, is no doubt same as Zolotniskii, N. F., p. 673. All entries should be referred to the latter author.

Steenstrup, J. J. S. 1842.1, p. 482, not on fishes.

Steindachner, A. 1882.1, p. 484, is a fictitious author.

Steindachner, F. 1910.4, p. 492, same as Steindachner, F. 1910.1, p. 492.

Steindachner, F. & Kner, R. 1860.1, p. 493, for correct citation see Steindachner, F. 1861.1, p. 485; — 1862.1, p. 493, see Steindachner, F. 1862.2, p. 485; — 1863.1, p. 493, see Steindachner, F. 1863.2, p. 485; — 1863.2, p. 493, see Steindachner, F. 1863.3, p. 485; — 1863.3, p. 493, see Steindachner, F. 1863.11, p. 486.

Storer, D. H. 1844.2, p. 507, same as Storer, D. H. 1844.9.

Storer, H. R. 1851.1, p. 508, correctly cited as Storer, D. H. 1851.2, p. 508.

Stromer, E. 1903.1, p. 511, not on fishes.

Studnička, F. J. 1901.1, p. 513, correctly cited as Studnička, F. K. 1901.3, p. 514.

Studnička, F. K. 1894.5, p. 513, same as Studnička, F. K. 1894.3.

Susari, Romeo. 1887.1, p. 522, correctly cited as Fusari, Romeo. 1887.3, vol. I, p. 432.

Sweet, G. 1906.1, p. 524, not on fishes.

Teodoro, F. 1871.1, p. 532, correctly cited as Todaro, F. 1870.1, p. 546.

Thilo, O., p. 535, 1896.1, included in 1896.2; — 1900.2, same as 1900.1; — 1901.2, included in 1899.2.

Thompson, P. 1877.1, p. 539, correctly cited under Thomson, P. 1877.1, p. 542.

Thompson, Wm. 1838.5, p. 539, same as 1838.3; — 1856.1, p. 540, same as 1849.1.

Thomson, —, 1910.1, p. 541, correctly cited as Thompson, D. W. 1910.1, p. 538.

Thoron, O. de, p. 542, better cited as Onffroy de Thoron, E. V., p. 211.

Thunberg, C. P. 1793.1, p. 544, included in Thunberg, C. P. 1792.1, p. 543.

Trachenberg, E. W. 1896.1, p. 550, correctly cited under Walter, E. 1896.1, p. 601. (Evidently of Trachenberg, Germany.)

Traquair, R. H. 1888.1, p. 553, included in 1888.3; — 1893.3, p. 554, same as 1895.1; — 1898.4, p. 555, same as 1897.5.

Trinchese, S. 1892.1, p. 559, instead of vol. 29, citation should be 1892, 5. ser. vol. 2, pp. 279–286.

Tucker, H. 1911.1, p. 565, not on fishes.

Ulrich, C. J. 1901.1, p. 569, not on fishes.

Victorin, J. F. 1858.1, p. 583, not on fishes.

Vincenzi, L. 1885.1, p. 585, not on fishes.

Vincenzo, C. G. 1883.1, p. 585, correctly cited as Ciaccio, G. V(incenzo), 1883.1, vol. I, p. 236.

Vivani, D. 1805.1, p. 588, not on fishes.

Vutskits, G. 1901.2, p. 592, same as Vutskits, G. 1901.1.

Wagner, Albertus. p. 593, 1860.1, correctly cited as Wagner, (J.) A. 1860.4, p. 594; — 1860.2, correctly cited as Wagner, (J.) A. 1860.1.

Waite, E. R. 1914.1, p. 597, included in Waite, E. R. 1913.3, p. 597.

Warren, H. Everett, 1896.1, p. 605, correctly cited as Everett, Warren H. 1896.1, vol. I, p. 377.

Wartmann, B. 1783.3, p. 606, same as Wartmann, B. 1783.1, p. 605.

Watase, S. 1894.1, p. 606, same as Watase, S. 1887.1, p. 606.

Weber, E. H., p. 608, 1827.2, correctly cited under 1827.1; — 1827.4, correctly cited under 1827.8; — 1827.5, correctly cited under 1827.9; — 1827.6, correctly cited under 1827.3.

Wegerland, N., p. 612, 1878.1, correctly cited under Wergeland, N. 1880.1, p. 617; — 1880.1, correctly cited under Wergeland, N. 1880.2.

Weigelt, A. 1900.1, p. 612, correctly cited under Weigelt, C. 1900.1, p. 612.

Wellburn, E. D. 1899.1, p. 614, same as Wellburn, E. D. 1900.3.

Weygandt, C. 1909.1, p. 619, not on fishes.

Wilder, B. G. 1877.2, p. 629, correctly cited as Wilder, B. G. 1878.1.

Williamson, H. C. 1850.1, p. 632, correctly cited as Williamson, W. C. 1851.1, p. 634.

Williston, S. W. 1894.1, p. 634, not on fishes.

Wolterstorff, W. G. 1905.1, p. 395, not on fishes.

Woodward, A. S. 1888.3, p. 646, same as 1888.9; — 1888.15, p. 646, same as 1888.14; — 1889.3, p. 647, same as 1889.7; — 1891.6, p. 648, same as 1889.10; — 1907.4, p. 652, same as 1907.2.

Wyman, J. 1854.2, p. 658, correctly cited as Wyman, J. 1854.5.

Young, J. 1843.1, p. 663, same as Young, Andrew, 1843.1, p. 662.

Anonymous. Delete the following numbers already cited under the authors named. No. 46, p. 678. See Cetti, F. 1777.1, p. 226, vol. I.

No. 78, p. 679. See Rooper, G. 1867.1, p. 359, vol. II.

No. 104, p. 681. See Goode, G. B. 1871.1, p. 484, vol. I.

No. 153, p. 683. See Denison, (Sir) W. 1862.1, p. 318, vol. I.

No. 158, p. 683. See Owen, R. 1854.1, p. 222, vol. II.

No. 159, p. 683. See O., 1832.1, p. 206, vol. II.

No. 163, p. 683. See Duhamel du Monceau, H. 1796.1, p. 338, vol. I.

No. 202, p. 684. See Bocage, J. V. 1878.1, p. 141, vol. I.

No. 267, p. 686. See Evermann, B. W. 1904.3, p. 380, vol. I.

No. 292, p. 688. See Reste, B. de 1801.1, p. 336, vol. II.

No. 306, p. 688. See Raveret-Wattel, C. 1874.1, p. 311, vol. II.

No. 307, p. 688. See Silk, M. 1880.1, p. 449, vol. II.

No. 344, p. 690. See Hoek, P. P. 1903.1, p. 587, vol. I.

No. 403, p. 693. See Davis, J. W. 1887.1, p. 300, vol. I.

No. 405, p. 693. See Yarrow, H. C. 1874.2, p. 661, vol. II.

No. 418, p. 693. See Baird, S. F. 1873.30, p. 55, vol. I.

No. 433, p. 694. See Bumpus, H. C. 1898.5, p. 201, vol. I.

No. 569, p. 699. See Zur Mühlen, M. von. 1911.18, p. 676, vol. II.

No. 596, p. 700. See Volpi, — 1796.1, p. 590, vol. II.

No. 607, p. 700. See Yarrow, H. C. 1876.1, p. 661, vol. II.

No. 608, p. 700. See Anon. 213, p. 685.

Addendum. Delete the following authors in this section.

Alexandrov, K. Add. 1909.1, p. 6, correctly cited under Aleksandrov, K. P. 1909.1, vol. I, p. 18.

Bellesme, J. de. Add. 1899.1, p. 17, correctly cited as Jousset de Bellesme, G. L. 1899.1, vol. I, p. 633.

Boursse Wils, H. Add. 1844.1, p. 24, correctly cited as Wils, H. B(oursse), 1844.1, vol. I, p. 635.

Carlson, U. Add. 1894.1, correctly cited as Carlsson, A. 1894.1, p. 217, vol. I.

Gilson, G. Add. 1908.1, p. 75, better cited under Gilson, G. 1908.1, vol. I, p. 474.

VIII

SUBJECT INDEX

MORPHOLOGICAL AND GENERAL SECTION ¹

ABDOMINAL PORES (OF FISHES)

Or *Pori abdominales*, including a discussion of the "genital pores" (*Pori genitales*) with which they have been frequently confused.

The abdominal pores

"Abdominal pores [as defined by Bles, E. J. 1898.1, p. 484] are the external apertures, usually paired, found in many Anamnia and some Amniota in the cloacal region, affording a passage of communication from the abdominal cavity to the exterior. The integument surrounding the pores externally is invariably ectodermic in origin, usually proctodæal. Internally the pores lead into the body cavity, or into passages — the peritoneal canals — communicating with the body-cavity."

They occur in numerous genera in the Cyclostomes, Elasmobranchs, Dipnoi, and Teleostomes, except in the Teleostei, where only two families possess them. They are subject to considerable variation in position and are often absent in individuals of species in which they normally occur. In other individuals they may be open on one side and closed on the other. In some species they open into the cloaca and in others, directly to the exterior. These minute openings are often difficult to demonstrate but, when present, they may generally be disclosed by injecting the body-cavity with mercury.

The abdominal pores are considered to be "excretory ducts" by Bles (E. J. 1898.2, p. 243) who has made the interesting observation that in those sharks in which open peritoneal funnels persist and function throughout life, the abdominal pores are generally absent. (For a further discussion of this subject, see below "Urogenital system of Elasmobranchii" under "Urogenital system.")

Gegenbaur (C. 1870.1) believed that, in the primitive vertebrates, the abdominal pores were probably the sole efferent channels for the sexual products. In contrast with this view, Bles (E. J. 1898.1, p. 505) believes that the abdominal pores "never serve under normal circumstances as genital ducts," this function being performed by the true gonoducts or where these have degenerated, as will be made clear later, by the "genital pores."

In the Teleostei, true abdominal pores occur only in certain genera (*Argentina*, *Coregonus*, and *Salmo*) of the Salmonidæ (used in the older sense), and, as was first pointed out by Hyrtl (C. J. 1856.1, Add. 1849.1), in various species of *Mormyrus* and in *Gymnarchus niloticus* of the Mormyridæ. The abdominal pores exist in both sexes.

The most illuminative and complete papers (in English), on the abdominal and genital pores, are those of ★Bles, E. J. 1898.1, 1898.2.

The most recent summary in German is that of ★Lickteig, A. 1913.1.

The subject of abdominal and genital pores in the Teleostei, is best treated by ★Weber, M. C. 1886.1.

The confusion, among the older writers, of abdominal and genital pores, especially of Balfour (F. M. 1876.2, p. 35), which was repeated by his pupil, Bridge (T. W. 1879.1), was first cleared by the remark of Huxley (T. H. 1883.2, p. 137) that the so-called abdominal pore of salmonoids "has nothing to do with the abdominal pores of . . . [Ganoids and] Selachians." This view was accepted by Gegenbaur (C. 1885.1). The confusion was finally cleared by the careful elucidation of ★Weber (M. C. 1886.1).

The genital pores

When the generative ducts (oviducts) disappear, their external openings persist as the *genital pores*. Through these openings the sexual products are extruded. Except possibly in the Cyclostomata, true "genital pores" exist, as far as known, only in two families of Teleosts, namely the Salmonidæ and the Anguillidæ. As long ago pointed out by Rathke (M. H. 1820.2), the oviduct in the eel has entirely disappeared. Various stages in the degeneration of the oviducts are found in the Galaxiidæ, Hyodontidæ, Notopteridæ, Osteoglossidæ, and in Misgurnus, as has been shown by Hyrtl (C. J. 1850.1, 1851.2) and by MacLeod (J. 1881.3). In the Salmonidæ, the oviduct has practically disappeared.

Abdominal pores and genital pores co-exist in but one family of Teleosts, namely in the female Salmonoid.

In the Mormyridæ, the only other family of Teleosts possessing abdominal pores, the oviducts have not degenerated so that genital pores are not present.

Pores of the Cyclostomata

In this group, the genital products (eggs and sperms) are discharged through a median pore or a pair of pores.

The exact morphological nature of these pores, i. e., whether abdominal or genital pores, remains in obscurity. Bles (E. J. 1898.2, p. 238) says that there is "great probability that the so-called abdominal pores of Cyclostomes are genital ducts, morphologically as well as functionally." Lickteig (p. 282), however, considers them to be true abdominal pores, and believes that it is only in this group that the abdominal pores serve as channels for the sexual products. From *a priori* considerations, this view is probably correct.

¹ Arranged under the 118 specific and technical headings herewith given.

For fossil forms, natural history, occurrence, taxonomy, etc., matters relating to specific fishes or groups of fishes, see in the Systematic Section.

Abdominal Pores — Cont'd.

In the lamprey (*Petromyzon*), in which the eggs are small, there is a pair of small pores opening into an urogenital sinus. Ewart, J. C. 1876.1.

In the *Myxinoids*, which have large eggs, *Myxine* possesses a single, median pore, of very considerable size, opening into a cloacal chamber, while *Bdellostoma* has an enormous pore divided into two. ★Burne, R. H. 1898.1.

Abdominal pores of Elasmobranchii

Abdominal pores are usually present in this group, but are subject to considerable variation, being often present on one side while absent on the other. The *Cestraciontidae* and *Rhinidae* lack them entirely. In other forms (*Scyllium stellare*, *S. canicula*, *Pristiurus melanostomus*, *Spinax niger*), they appear only at sexual maturity and may in certain individuals be absent.

A table showing their distribution appears in ★Bles, E. J. 1898.2.

Other papers of lesser importance relating to the abdominal pores of sharks are Bridge, T. W. 1879.1; Howes, G. B. 1890.3; Schneider, G. 1897.1; and Turner, W. 1879.1.

Abdominal pores in Teleostomi

The distribution of abdominal pores in this group, together with the literature, is fully given by Bles (E. J. 1898.1).

The *Crossopterygii* possess them as demonstrated in *Polypterus* by Hyrtl, and in *Calamoichthys* by Bridge.

The *Chondrostei*: *Polyodon* has abdominal pores (A. Wagner, and Hyrtl); while practically all species of *Acipenser* have them (Johannes Müller, Hyrtl, and Stannius).

The *Holostei*: "*Amia calva* — This fish was carefully examined by Hyrtl, and at first without success, for the presence of abdominal pores. He discovered them in a large specimen as very fine canals . . . Bridge confirms Hyrtl's observations, adding that the pores are open in both sexes."

"*Lepidosteus osseus* finally, like all other known Ganoids, has abdominal pores. They were described and figured by Hyrtl and mentioned by Bridge, but were first discovered by Joh. Müller." (Bles, E. J. 1898.1, p. 502.)

Various papers on the abdominal pores of the *Teleostomes*, are Ayers, H. 1884.1; Hyrtl, C. J. 1852.1, 1854.2; and Ionescu, C. N. 1905.1.

Abdominal pores of Dipnoi

"According to Hyrtl, *Lepidosiren paradoxa*, Fitz., has no peritoneal canals or abdominal pores; and Bischoff [T. L. 1840.1] . . . makes no mention of such openings. *Ceratodus*, on the other hand is well known to have pores, as first described by Günther [A. C. 1871.4], paired and opening behind the cloaca.

" . . . *P[rotopterus] annectens* . . . has abdominal pores." Bles, E. J. 1898.1, p. 504.

ADAPTATIONS

See also Ecology, Evolution, etc.

For adaptations to varying saline content of water; adaptations of freshwater fishes to seawater and vice versa, see under Physiology.

For adaptation of coloration to surroundings, see under Coloration; in form or shape of fishes, see under Form.

For adaptations to their peculiar habitat and manner of life, see Blind Fishes of the Caves, Deep Sea Fishes, and Pelagic Fishes.

Generalia. Agassiz, J. L. 1854.4; Baird, S. F. 1871.47; ★Eigenmann, C. H. 1909.1 (Address); Fatio, V. 1904.1, 1905.1; Nichols, J. T. 1915.1, 7; Osburn, R. C. 1911.11; Prince, E. E. 1901.1.

Adaptations to an aquatic habitat. Abel, O. 1905.1. — *To terrestrial existence*. Cuénot, L. 1895.1. — *Deep-sea fishes*. Delaroche, F. E. 1809.3. — *Adaptations of sailfishes to a pelagic life*. Dollo, L. 1909.5. — *Adaptations illustrating "habitus" and "heritage."* Gregory, W. K. & Adams, L. A. 1914.1. — *Sagittiform structure of nectonic fishes*. Schlesinger, G. 1909.1.

Adaptations of Scomberesocidae to a pelagic manner of life. Schlesinger, G. 1909.2. — *Adaptations of Mormyridae to manner of food gathering*. Schlesinger, G. 1910.2, 4. — *Adaptation of Gobiidae to a planktonic life*. Brunelli, G. & Atella, E. Add. 1914.1.

Adaptations of fossil fishes to their manner of life. ★Dollo, L. 1909.4; Abel, O. Add. 1914.1.

ADHESIVE DISK

General treatise on the adhesive disk of fishes. ★Niemic, J. 1885.1.

Fixation against the current by means of spines acting as adhesive organs. Thilo, O. 1900.1, 2, 1903.1.

Disk formed through a modification of the dorsal fin. — *In Echeineis*. Beck, G. 1879.1; Cope, E. D. 1889.4; Home, E. 1816.1; ★Houy, R. 1909.1; Storms, R. 1888.1; Townsend, C. H. 1915.1. — *Fossil showing disk*. Wettstein, A. 1886.1.

In Remora. Baudelot, E. 1867.3; Blainville, H. M. 1822.2; Kner, R. 1860.2.

Disk formed by the united ventral fins. *In Cyclopterus*. Baudelot, E. 1868.7; Borckert, H. 1889.1; ★Guitel, F. 1891.3, 1896.1. — *Liparis*. Reicher, E. 1913.1; Stuckens, M. 1884.1; Smith, W. A. Add. 1885.1. — *Lepadogaster*. Fiebiger, J. 1905.1; Smith, W. A. Add. 1885.1.

ADHESIVE OR CEMENT ORGANS

Transient larval organs, situated as a crescent-shaped median furrow or a pair of knobs near the mouth, being glandular and serving to aid in the attachment or cementing to surroundings of the larval fishes.

In *Amia*, as first pointed out by Reighard and Phelps (1908.1), these are of endodermal origin arising in the form of pockets which later, however, separate and fuse with the ectoderm. By them, they were homologized with the anterior pair of head cavities of Elasmobranchs. Kerr (J. G. 1906.1) has suggested their possible correspondence with the premandibular head cavities of higher vertebrates.

In *Dipnoi* (*Protopterus* and *Lepidosiren*), and *Amphibia*, the cement organs are apparently of ectodermal origin, but Professor Kerr believes that here the endodermal stages have been eliminated from the embryonic development.

Structure and development in — *Protopterus*, *Hyperopisus*, and *Sarcodaces*.

Budgett, J. S. 1900.5. — *Amia*. ★Eycleshymer, A. C. & Wilson, J. M. 1908.1; Phelps, J. 1900.1; Reighard, J. E. 1900.2; Reighard, J. E. & Phelps, J. 1908.1. — *Lepidosiren* and *Protopterus*. Kerr, J. G. 1900.1 (iii). — *Polypterus*. Kerr, J. G. 1907.2. — *Acipenser*. Kupffer, C. 1893.1; ★Sawadsky, A. M. 1911.1,2.

ÆSTIVATION

The manner in which fishes survive drying of water courses by embedding in mud, etc.

Miscellaneous. Huard, V. A. 1903.1; Milewski, A. 1915.9. — *Earliest known account of this phenomenon*. Theophrastus. Pre-Linn. 1495.1.

Æstivation of various fishes. — *Embedding of carp, perch, etc., in mud at disappearance of the stream and their reappearance after rainfall*. Buchanan, J. Y. 1911.1. — *Indian fishes*. ★Day, F. 1877.3. — *Lepidosiren*. Kerr, J. G. 1898.2, 1900.1. — *Galaxias*. Hall, T. S. 1901.1; Fletcher, — Add. 1906.1; Stead, D. G. Add. 1907.6, 7. — *Australian fishes*. Spencer, B. Add. 1896.1.

Æstivation of the African lungfish, Protopterus; structure, chemical composition, etc., of the cocoon, resumption of active life after the torpid condition, etc. Allen, G. 1885.1; Dean, B. 1912.5; Dubois, R. 1892.1; Geoffroy-Saint-Hilaire, A. 1863.1; Jardine, W. 1841.1; Macdonnell, R. 1860.1; Meyer, R. 1866.1; Parker, W. N. 1888.2, 1889.2, 1892.1; Sarasin, F. 1905.1; Walther, G. 1889.1; Wiedersheim, R. E. 1887.3.

For the manner in which fishes pass the winter season, see Hibernation.

For Burrowing Habits of various non-æstivating fishes, see this subject under Habits of Fishes.

AIR BLADDER

General accounts of the anatomy, physiology, etc. ★Bridge, T. W. 1890.2, 1904.1; ★Bridge, T. W. & Haddon, A. C. 1889.1, 1893.1; Day, F. 1880.1,8; Döllinger, I. 1804.1; Hasse, J. C. 1873.1; Lloyd, J. 1869.1; Morris, C. 1886.1; Reis, K. 1907.1; Reissner, E. 1859.2.

Miscellaneous papers on the air bladder. Bist, — 1807.1; Günther, A. C. 1874.2; Hancock, J. 1830.1; Houghton, W. 1868.2; Huber, R. O. 1908.1; Janson, O. 1905.1; Leonhardt, E. E. 1905.2; Prudhomme, — 1811.1; Süssdorf, J. 1862.1; Vion, R. 1881.2; Anon, 439, 532, 566; Foley, A. Add. 1863.1. — *Pre-Linn. refs.* Hanow, M. 1737.1; Ray, J. 1675.1.

Development of air bladder. General discussions. Agassiz, J. L. 1850.8; Baer, K. E. 1834.1, 1836.1,2,3; ★Moser, F. 1903.1; Stricker, F. 1899.1; Thilo, O. 1904.1; ★Goeppert, E. Add. 1902.1.

Development of air bladder in — *Clupea*. Nedozhivin, A. J. 1912.1. — *Tetrodontidae, and carp*. Thilo, O. 1899.1, 1908.3, 1914.1. — *Lophobranchii*. Weber, A. 1886.2,3.

Homologies with lungs. *Consideration of the genetical relations existing between the air bladder of fishes and the lungs of higher vertebrates. Conclusions based chiefly upon the study of the Dipnoi.*

Considered homologous. Greil, A. 1905.1; Kerr, J. G. 1908.1; Morris, C. 1892.1; Goette, A. 1904.1; Müller, F. W. 1911.1; ★Spengel, J. W. 1904.1; Wiedersheim, R. E. 1904.2; Makuschok, M. Add. 1913.1; Oppel, A. Add. 1905.1.

Considered not homologous. Albrecht, P. 1886.1; Müller, J. 1841.4.

For the structure of the air bladder in individual Dipnoi, see below under Specialized air bladders.

Anatomy and morphology

For the connections with the membranous labyrinth by tubular prolongations, and by the Weberian apparatus, see under Auditory organs.

Larger, and more important papers on the anatomy and morphology of the air bladder. Deinek, D. I. 1901.1, 1904.1; Jacobi, H. S. 1840.1; Jacobs, C. 1898.1; ★Jaeger, A. 1903.1; Müller, J. 1842.2; ★Reis, K. 1907.1; Tracy, H. C. 1910.2, 1911.1; Oppel, A. Add. 1906.2.

Various smaller papers. Baudelot, E. 1873.1; Berlack, J. 1834.1; Cuénot, L. 1887.1; Cuvier, G. L. 1809.1; Delaroche, F. E. 1809.2; Faivre, E. 1854.1; Huschke, E. 1818.1; Kner, R. 1864.3; Rathke, M. H. 1827.1.

Earliest general account. Fischer von Waldheim, G. 1795.1. — *Considered a degenerate gland*. Prince, E. E. 1906.1. — *Ossified in certain fishes*. Thilo, O. 1913.1.

Ducts for the communication of the air bladder with the exterior.

Ductus pneumaticus, connection between air bladder and alimentary canal, of Physostomi. ★Rowntree, W. S. 1903.1.

Posterior communication with cloaca in herring. Bennett, F. W. 1879.1; Starks, E. C. 1911.1. — *No cloacal communication in Ophiocephalus*. Starks, E. C. 1911.2.

Duct ending in right branchial cavity of Caranx. Moreau, F. A. 1875.1,6, 1876.1,4.

Retia mirabilia. *Called also red glands, gas glands, ovals, etc.*

For an old but excellent account of Retia mirabilia in teleostean fishes, see Müller, J. 1840.4.

Morphology, histology, functions, etc. Coggi, A. 1886.1, 1889.1; Corning, H. K. 1888.1; Nusbaum, J. 1907.2; Nusbaum, J. & Bykowski, L. (Fierasfer) 1904.1, 1905.1; Nusbaum, J. & Reis, K. 1905.1; Quekett, J. T. 1842.1; ★Reis, K. 1906.1, 2; Reis, K. & Nusbaum, J. 1905.1, 1906.1; Robin, C. P. 1883.1; Seabra, A. F. 1897.1; Vincent, S. & Barnes, A. S. 1896.1; ★Woodland, W. N. 1908.1, 1911.1,2, 1911.3, 1913.1.

Rudimentary, and degenerate air bladders. — *In Selachii*. Mayer, P. 1894.2; Miklukho-Maklai, N. N. 1867.1. — *In young of Comephorus baicalensis*.

Air Bladder — Cont'd.

Reis, K. 1909.1. — *Degeneration in Pleuronectidae*. Thilo, O. 1907.3.

Specialized air bladders, including the so-called "lung" of *Dipnoi* or *Lungfishes*.

For the use of these organs in breathing, see Aerial respiration under Respiration.

Anatomy and development of lung in the lungfish, Neoceratodus. Günther, A. 1871.4; Neumayer, L. 1904.1; Wilson, G. 1901.2. — *Neoceratodus and Protopterus*. Spencer, W. B. 1898.1.

Anatomy in Lepidosteus. Hoeven, J. 1841.1; Hyrtl, C. J. 1852.2; Packard, A. S. 1859.1; Poey y Aloy, F. 1858.1; Valentin, G. G. 1840.1.

Anatomy in Polypterus. Harrington, N. R. 1899.2; Wiedersheim, R. E. 1906.1.

Larynx: occurrence, anatomy, musculature, etc., in Dipnoi and Ganoidei. ★Wiedersheim, R. 1904.2, 1904.1, 3.

Anatomy and morphology of the air-bladder of various Teleosts

Physoclisti, fishes lacking an open ductus pneumaticus from the air-bladder to the oesophagus. — *Dactylopterus*. Calderwood, W. L. 1890.1. — *Sciaenidae*. Cohn, L. 1907.1; Cuvier, G. L. 1815.1. — *Uranoscopus*. Costa, O. G. 1846.4. — *Caranx*. Hyrtl, C. J. 1849.3. — *Macropodus*. Marcinkiewicz, M. 1911.1. — *Ophidium*. Putnam, F. W. 1874.4. — *Oligopus (Gadopsis)*. Filippi, F. Add. 1855.1. — *Plecognathus*. Rosén, N. 1912.1, Add. 1912.1.

Physostomi, fishes having an open ductus pneumaticus communicating with the oesophagus. — *Malacopterygii*. ★Beaufort, L. F. 1909.1.

Air bladder of certain Cyprinidae. — *Nemachilus*. Bloch, L. 1900.1. — *Cobitidae*. Grobben, C. 1875.1; Jaquet, M. 1894.2. — *Cyprinidae*. ★Guyénot, E. 1906.1; Leonhardt, E. E. 1903.11.

Structure of air bladder in various Siluridae. Bridge, T. W. 1890.1. — *Doras*. Kner, R. 1854.3. — *Amiurus*. Macallum, A. B. 1884.1. — *Siluroides nebulosus*. Reis, K. 1905.1.

Air bladder of Notopterus. Bridge, T. W. 1900.1. — *Esox*. Czermák, J. N. 1850.1. — *Coregonus and Anguilla*. Haempel, O. 1909.1. — *Erythrinus*. Jacobi, H. S. 1840.1. — *Carapus*. Kaup, J. J. 1856.5. — *Apodes*. Kner, R. 1866.6. — *Anguilla*. Pauly, A. 1882.1. — *Gymnotini*. Reinhardt, J. T. 1852.1. — *Pæciliidae*. Langer, W. F. 1913.1. — *Clupeidae*. Regan, C. T. 1911.1; Ridewood, W. G. 1891.1.

Nature of gaseous content

The gases of the air bladder consist of oxygen and nitrogen with small quantities of carbon dioxide.

Various papers, researches, notes, etc. Biot, J. B. 1807.1, Add. 1807.1; ★Bohr, C. 1892.1; Erman, P. 1808.1; Fourcroy, A. F. 1789.1; ★Huefner, C. G. 1892.1; ★Moreau, F. A. 1862.2, 1863.3, 4, 1864.3–1879.1; Richard, J. 1895.1, 1896.2; Schloesing, T. & Richard, J. 1896.1

(Argon); Schultze, F. 1872.1; Tower, R. W. 1902.2; Traube-Mengarini, M. 1887.1, 1889.1, Add. 1888.1; Brodbelt, F. R. Add. 1796.1, 1797.1; Configliacci, P. Add. 1809.1, 1811.1; Krukenberg, C. F. Add. 1881.1.

Variation at different depths (almost pure oxygen at greater depths). Moreau, F. A. 1874.1, 2, 1875.4; Wittmack, M. C. 1876.1.

Physiology and functions

For the air bladder as a respiratory organ, see Aerial respiration under Respiration.

For the action of the extrinsic muscles of the air bladder in producing sounds, see under Sound production.

General treatises on the physiology of the air bladder. ★Baglioni, S. 1908.3; Bjeletskij, N. F. 1883.1; ★Popta, C. M. 1910.1, 1912.1; Kuiper, K. Add. 1914.1.

Other important accounts. ★Guyénot, E. 1909.1, 1912.1; Jaeger, A. 1903.1–1906.1; Liebreich, O. 1890.1, 2; Marangoni, C. 1879.1, 1880.1; Treviranus, G. R. 1812.1, 1817.1; Wegener, M. 1910.2; Priefer, B. Add. 1892.1.

Shorter and non-technical accounts. Day, F. 1880.3; Erxleben, J. C. 1798.1; Geoffroy-Saint-Hilaire, E. 1809.3; Gorka, S. 1908.1; Gouriet, E. 1866.1; Meigen, — 1856.1; Quekett, J. T. 1842.1; Reis, K. & Nusbaum, J. 1907.1; Sprenger, W. 1900.4; Waldschmidt, J. 1906.1; Lendenfeld, R. Add. 1897.1.

Experimental researches: effects on gas production of transection of the vagus and sympathetic nerves. Bohr, C. 1894.1; Harting, P. 1865.1; Moreau, F. A. 1865.1. — *Results of excision.* Giaja, J. 1908.1. — *Use of physometer.* Harting, P. 1872.2, 1874.2.

Belief that air bladder is filled only through ductus pneumaticus. Thilo, O. 1914.1.

Earliest scientific work on functions of air bladder. Borelli, G. A. Pre-Linn. 1680.1; J. A., 1675.1.

Hydrostatic functions, or the methods by which fishes rise and sink. Bonnier, P. 1895.1; ★Charbonnel-Salle, L. 1887.1; Corbclin, H. 1887.1; Dei, A. 1895.1; ★Moreau, F. A. 1875.3, 5, 6, 1876.5, 1879.1; Regnard, P. 1895.2; Hesse, R. Add. 1913.1; Musy, M. Add. 1912.1.

Density of fishes: fresh-water fishes weigh slightly less, most marine forms slightly more, and Pleuronectidae relatively much more, than the amount of water displaced. Magnan, A. & La Riboisière, J. 1912.2.

ALIMENTARY CANAL OF FISHES

Comprising the morphology of the digestive tract in fishes.

For the functions of the alimentary canal, see Digestion.

For other organs derived from or associated with the alimentary tract, see Air bladder, Liver, Pancreas, Spleen, etc.

For an exhaustive treatise on the histological structure of the alimentary canal with a full bibliography, consult ★Oppel, A.

(1896.1), "Lehrbuch der vergl. Mikro. Anat.," 1896, pt. 1, (Magen) pp. 28-88; pt. 2, (Schlund u. Darm) 32-54; 160-170. For references to pt. 3, see Oppel, A. Add. 1900.1.

For a readable summary, see the chapter in ★Bridge, T. W. 1904.1.

ORAL CAVITY, PHARYNX, AND OESOPHAGUS

For general discussions of the development of these parts, see ★Goeppert, E. Add. 1902.1; and ★Oppel, A. Add. 1900.1.

For various pharyngeal derivatives, see Post-branchial body, Thymus Gland, Thyroid Gland, etc.

Phylogeny of the mouth, "the old mouth and the new," etc., chiefly discussions of Dohrn's theory of the origin of the present mouth of vertebrates through the coalescence of a pair of gill-clefts. Beard, J. 1888.4; Dohrn, F. A. 1882.2 (i); Fürbringer, M. 1900.1; Gaskell, W. H. 1898.1 (vi); Jaekel, O. 1906.4, 1907.1; Ayres, H. Add. 1907.1.

Embryological development of the oral or buccal cavity or mouth in — *Amphioxus*. Legros, R. 1898.1. — *Cyclostomata*. Peter, K. 1906.1. — *Bdellostoma*. Stockard, C. R. 1906.2. — *Acipenser*. Zavadskii, A. M. 1912.1.

Structure of the protrusible, spout-like mouth parts of *Acipenser*. Jourdain, S. & Friant, A. 1877.1.

Structure of the lips of *Capoeta* and *Schizothorax*. Pavlovskii, E. 1910.1, 1911.1.

Hypobranchial groove of *Tunicates*, *Amphioxus*, and *Cyclostomes*. Müller, W. 1873.1.

For cases of Buccal occlusion or absence of mouth, see Abnormalities of skull under Teratology.

Anatomy of — *Oesophagus* in *selachii*. Kreuter, E. 1903.1. — *Pharynx* in *Ganoids* and *Dipnoi*. Wiedersheim, R. E. 1904.2, 3. — *Oesophageal papillæ*. Gerhardt, U. Add. 1914.1.

Histology of the lining epithelium (generally squamous) of the buccal cavity or *oesophagus* in — *Unclassified*. Bornaud, E. 1887.1. — *Torpedo*. Drzewina, A. 1909.1, 1910.2. — *Cyprinidæ*. Pictet, A. 1909.2. — *Ammocætes*. Schaffer, J. 1895.1. — *Chimæra*. Studnicka, F. K. 1902.2.

Adenoid organ, a large lymphoid organ embedded in submucosa of *oesophageal* wall of *Selachii*. Drzewina, A. 1904.3, 1905.1, 1910.2; Kulchitzkii, N. 1911.1.

So-called "salivary" gland (of unknown function) of *Petromyzon*, only oral gland of the *Ichthyopsida*. Born, G. 1828.1; Giacomini, E. 1900.2; ★Haacke, J. W. 1903.1; Rathke, M. H. 1823.1, 1825.1; Reichel, P. 1882.1.

Description of a pair of lateral pharyngeal pouches in *Scarus* presumed to serve as reservoirs for food. Sagemehl, M. 1885.1.

Posterior openings of nares in *pharynx* of — *Astroscopus*. Dahlgren, U. 1908.2. — *Cynoglossus*. Johnstone, J. 1904.3; Kyle, H. M. 1900.6.

Morphology of the tongue in fishes. Chaine, J. 1900.2, 1901.1, 1902.2, 1907.1; ★Gegenbaur, C. 1894.1; ★Hörschelmann, — 1866.1.

For the "tongue-bone" or the basi-hyal element of the hyoid arch and its musculature, see under Visceral skeleton.

STOMACH

(As characterized by the presence of gastric glands, the *Dipnoi* and *Cyprinidæ* lack a true stomach.)

For the best systematic treatment, see ★Oppel, A. cited above.

Various papers on the structure of the stomach. Gregory, W. K. 1904.1; Gegenbaur, C. 1878.1; Hancock, J. 1830.1; Heusner, L. 1905.1; Ricci, N. 1875.1; Stricker, F. 1899.1; Supino, F. Add. 1914.1.

Structure of the stomach in — *Cetorhinus*. Home, E. 1809.1, 1813.1. — *Amia*. Hopkins, G. S. 1891.1. — *Salmonidæ*. Kner, R. 1851.1, 1852.1. — *Silurus*. Retzius, A. J. 1842.1. — *Trout and herring*. Williamson, H. C. 1896.1.

Histological structure of the gastric epithelium. Glinsky, — 1883.1; Kolster, R. 1907.1; Pilliet, A. H. 1893.1, 1894.1; Stirling, W. 1884.1; Biedermann, W. Add. 1875.1; Bischoff, T. W. Add. 1838.1.

Histology of the gastric or peptic glands. (Edinger concluded that these contain only one kind of cell which is not homologous with either the "central" or the "parietal" cells of the mammalian stomach.) Cattaneo, G. 1886.1, 3, 1892.1; Edinger, L. 1876.1; Monti, R. 1898.3; Nussbaum, M. 1882.1; Oppel, A. 1896.2; Valatour, M. 1861.1; Garel, J. Add. 1879.1.

Tunica Muscularis

(The muscular coat of the alimentary canal.)

Histogenesis of striated muscle in *oesophagus* of dogfish. McGill, C. 1910.1.

Taxonomic characters afforded by muscular sheath of *oesophagus*. Gulliver, G. 1842.1, 1870.2.

The muscular coat of the stomach and intestine in most fishes and in all other vertebrates consists of an inner circular and an outer longitudinal layer of smooth muscle fibers. However, in some teleosts, *Cobitis* (*Misgurnus*), *Solea*, *Syngnathus*, and *Tinca*, the striated fibers of the *oesophagus* are continued into the walls of the stomach and intestine where they are disposed in an inner circular and an outer longitudinal layer, in addition and external to the two inner layers of smooth fibers.

For a general discussion, see ★Oppel, A. 1896.1 (pt. 1, p. 44); for conditions in *Syngnathus*, see Pilliet, A. H. 1885.1; discovery, in *Cobitis*. Budge, J. Add. 1847.1.

Solea sp. has an inner striated circular layer and an outer smooth longitudinal layer. Oppel, A. 1896.1 (pt. 1, p. 77); Valatour, M. 1861.1.

Structure, histology, etc., of striated layers of intestine of tench, *Tinca vulgaris*.

Alimentary Canal — Cont'd.

Du Bois-Reymond, R. 1890.1; Molin, R. 1850.2; Oppel, A. 1896.1 (pt. 1, p. 74); Retterer, E. & Lelièvre, A. 1909.1.

Experimental results of induction current, curare, etc., reveal specific rapid and slow reactions respectively of striated and non-striated fibers. ★Mahn, R. 1898.1. — *Comment on this.* Wood, H. C. 1898.1.

INTESTINE

For a comprehensive general treatise, in German, see ★Jacobshagen, E. 1911.1.

For a full review in French, see ★Yung, E. J. Add. 1899.1.

For the lymphatics of the intestine, see Special parts under Lymphatic under Circulatory system.

Variations in length of intestine, influence of food upon length, etc. Babák, E. 1903.1; Bloch, A. 1904.1.

Cloacal epithelium of Selachii. List, J. H. 1884.1, 1885.1, Add. 1884.1, 1886.1.

Peritoneum or serous envelope of the intestine in Pleuronectidae. Sauvage, H. E. 1908.1.

Pigmentary cells of the intestine. Oppel, A. 1889.1.

Bursa Entiana or duodenal segment of the intestine of Selachii, anatomy. Redeke, H. C. 1900.1, 2.

Papers dealing primarily with the histological structure of the intestinal epithelium. Arcangeli, A. 1906.1–1909.1; Bizzozero, E. 1904.1; Drzewina, A. 1912.1; Edinger, L. 1876.1, Add. 1887.1; Fuhrmann, O. & Yung, E. (Lota) 1900.1; ★Pictet, A. 1909.2; Sullivan, M. X. 1905.1; Sundvik, O. 1907.1; Waalewyn, H. W. 1872.1; Yung, E. J. 1898.2; Garel, J. Add. 1879.1; Pogonowska, I. Add. 1912.1.

Other papers on the structure and development of the intestine. Cajetan, J. 1883.1; Cattaneo, G. 1886.2, Add. 1886.1, 2; ★Egounoff, S. 1907.1; Egounoff, S. & Yung, E. 1907.1; Gemmill, J. F. 1899.1; ★Howes, G. B. 1890.2, 3; Knauthe, K. 1897.1, 1898.1; Pilliet, A. H. 1885.1; Piper, H. 1902.3; Rathke, M. H. 1820.1, 1825.2; Reinhard, W. 1888.1; Grimm, J. D. Add. 1866.1; ★Maurer, F. Add. 1906.1.

Structure and development, including the histological structure of the epithelium in various groups of fishes.

Cyclostomata. — *Petromyzon.* Claypole, A. M. 1895.1. — *Myxine.* Cole, F. J. 1905.1 (v); Maas, O. 1899.1; Schreiner, K. E. 1899.1.

Dipnoi. — *Lepidosiren.* Ehlers, E. H. 1895.1. — *Neoceratodus.* ★Neumayer, L. 1903.1, 1904.1. — *Protopterus.* Laguesse, G. E. Add. 1890.1.

Ganoidei; Amia and Acipenser. Hilton, W. A. 1900.1; ★Hopkins, G. S. 1892.1, 1893.1, 1895.1; Macallum, A. B. 1886.1.

Selachii. Duvernoy, G. L. 1835.1; Helbing, H. 1903.1; Petersen, H. 1908.1. — *Scyllium.* Guieysse-Pellissier, A. 1911.1, 1912.1, 1913.1. — *Hypnos subnigrum.* Howes, G. B. 1890.3. — *Manta.* Mazza,

F. 1891.1. — *Carcharias.* Steenstra-Toussaint, A. J. 1843.1.

Teleostei. — *Clarias.* Böhme, R. 1904.1. — *Clupea.* Day, F. 1882.2. — *Anarrhichas.* Haus, G. A. 1897.1. — *Macruridae.* ★Krumholz, J. 1910.1. — *Ameiurus.* Macallum, A. B. 1884.1. — *Regalecus.* Mazza, F. 1900.1, 1901.1. — *Teleostei.* Nusbaum-Hilarowicz, J. 1915.4. — *Cyprinidae.* Pictet, A. 1909.1, 2. — *Plectognathi.* Rosén, N. 1912.1. — *Gadus.* Thesen, J. E. 1890.1. — *Luvarus.* Haller, B. Add. 1881.1.

Structure, including the intestinal epithelium, in the loach, Cobitis (Misgurnus). This form has capillary blood-vessel plexuses in the walls of the submucosa. Calugareanu, D. 1907.1; Eberth, C. J. 1862.1; Leydig, F. 1853.2; Lorent, H. 1878.1; Lupu, H. 1907.1, 1908.1, Add. 1909.1, 1914.1; Paneth, J. Add. 1889.1.

For the use of the intestine by Cobitis in breathing, see Intestinal respiration under Respiration.

Lateral position of vent in Amphioxus. Wilder, B. G. 1874.1.

Appendix Digitiformis or "Rectal gland"

Called also digitiform gland, processus digitiformis, and superanal gland. It is situated in the terminal portion of the intestine of Elasmobranchii and is possibly homologous with the cæcum coli of higher vertebrates.

Anatomy, development, and possible functions in Selachii. Blanchard, R. 1878.1, 2, 1882.2; Crawford, J. 1901.1; ★Howes, G. B. 1890.2; Mazza, F. 1898.1; Morgera, A. 1910.1, 1914.1; Pixell, H. L. 1908.1; Sanfelice, F. Add. 1889.1.

Structure in Chimæra. Mazza, F. & Perugia, A. 1894.1; Leydig, F. Add. 1851.1.

For references to the possibly homologous intestinal cæcum of some teleosts, see Howes, G. B. 1890.2; *see also* Budge, J. 1848.1.

Appendices pyloricæ or Pyloric cæca

Structure in Teleostei. Hyrtl, C. J. 1865.1; ★Kostanecki, K. 1913.1. — *Salmonidae.* Cattaneo, G. 1900.1; Day, F. 1887.4, 5; Kner, R. 1851.1, 1852.1. — *Centrarchidae.* Johnson, R. H. 1907.1. — *Centrolophus.* Riggio, G. 1894.2. — *Xiphias.* Rosenthal, F. 1824.1.

For the functions of the pyloric appendages, see Intestinal digestion under Digestion.

Pair of cæca of anterior part of intestine of Greenland shark (Læmargus). Gegenbaur, C. 1892.1; Turner, W. 1873.1.

Spiral Valve

Structure and development, chiefly Selachii. Duvernoy, G. L. 1833.1, 1835.1; ★Kantorowicz, R. 1897.1; Mayer, P. 1898.1; Neuville, H. 1897.3, 1901.2; ★Parker, T. J. 1885.1; Rückert, J. 1896.1, 2.

Earliest references and figures. Alopias. Perrault, C. Pre-Linn. 1671.1. — Raja. Steno, N. Pre-Linn. 1664.2–1675.1.

*Spiral valve in Plagiostomi and Cera-
todus. (Figures.)* Garman, S. 1913.1.

*Coprolites or petrified faeces: fossilized
moulds of the spiral valve, accompanying
remains of fossil fishes.* Dean, B. 1909.5;
Leydig, F. 1896.1; Neumayer, L. 1904.2,
1914.1; Sacco, F. 1886.1; Fischer von
Waldheim, G. Add. 1835.1.

*Manner of formation of helicoidal faeces
in Protopterus.* Dean, B. 1903.4; Vail-
lant, L. L. 1896.6.

ANATOMY AND MORPHOLOGY

The present section includes only works on
the general anatomy and morphology of fishes.

References to the structure and morphology
of individual organs and systems, occur under
these topics.

For the morphology of fossil fishes see under
the fishes in the Systematic Section. See also
the section on Palæontology.

*For general accounts on the anatomy of
fishes, with references to the literature, etc.,
see* ★Bridge, T. W. 1904.1; ★Kerr, J. G.
1910.1.

*Various topics; unity of the gnathostome
type, ground plan of vertebrate structure,
the morphological method, etc.* Ayers, H.
1906.1; Hilgard, T. C. 1871.1; Jaekel,
O. 1896.2, 1906.1; Kerr, J. G. 1906.1,
1910.2; Gill, T. N. Add. 1881.3.

*Miscellaneous, unimportant, and un-
classified items on the anatomy of fishes.*
Autenrieth, J. H. 1800.1; Batarra, G.
1771.1; Davy, J. 1839.2; Jaquet, M.
1894.1; Kuhl, H. & Hasselt, J. K. 1820.1,
1824.1; Monro, A. 1785.1, 1787.1; New-
ton, E. T. 1895.1; Rabuteau, A. P. &
Papillon, F. 1874.1; Rawitz, B. 1882.1;
Schneider, J. G. 1787.1, 1795.1; Stan-
nius, F. H. 1839.1; Szibenliszt, M. 1841.1;
Vicq-d'Azyr, F. 1776.1; Winkler, G.
1876.1.

*Early writings on anatomy, references in
Pre-Linn. section.* ★Artedi, P. 1738.1;
Francesco, G. G. 1625.1; Gering, J. 1727.1;
Germano, F. 1625.1; Hebenstreit, J.
1733.2; Jacobæus, O. 1696.1-1710.1;
Koenig, E. 1687.1; Leeuwenhoek, A.
1684.1-1694.1; Preston, C. 1698.1;
Roberg, L. 1749.1; ★Scheuchzer, J. J.
1703.1; Steller, G. W. 1753.1.

Comparative anatomy of vertebrates

(Text-books, manuals, handbooks, etc.,
on comparative anatomy including fishes).

Text in English. Cuvier, G. L. 1802.1;
Gegenbaur, C. 1878.2; Home, E. 1814.1;
Huxley, T. H. 1871.1; Jones, T. Rymer,
1861.1; Kingsley, J. S. 1912.1; Parker,
T. J. 1884.1; Rolleston, G. 1870.1, 1888.1;
Todd, R. B. 1859.1; Owen, R. 1846.1,
1866.3; ★Wiedersheim, R. E. 1897.1.
— *Pre-Linn. treatises.* Collins, S. 1685.1;
Monro, A. 1744.1.

Text in French. Chatin, J. 1880.1; Cu-
vier, G. L. 1800.1, 1817.1, 1829.1, 1836.1;
Edwards, H. M. 1857.1; Humboldt, F.
H. & Bonpland, A. J. 1805.1; Vialleton,

L. 1911.1; Vogt, C. C. & Yung, E. 1888.1;
Carus, C. G. Add. 1833.1.

Text in German. Brandt, A. T. 1911.1;
Brül, C. B. 1877.1; Carus, C. G. 1818.1;
Cuvier, G. L. 1809.2, 1831.1, 1846.1;
★Gegenbaur, C. 1859.1, 1864.3, 1870.1,
1874.1, 1878.3, 1898.1; ★Haller, B.
1904.1; Humboldt, F. H. & Bonpland,
A. J. 1806.1; Kuhl, H. 1820.1; Mayer,
A. F. 1835.1; Nuhn, A. 1878.1; Schneider,
A. F. 1879.1; Siebold, C. T. & Stannius,
F. H. 1845.1, 1846.1, 1854.1; Stannius,
F. H. 1846.2, 3; Vogt, C. C. & Yung, E.
1885.1; ★Wiedersheim, R. E. 1884.1,
1886.1, 1898.1, 1906.1; Schimkewitsch,
W. Add. 1910.1.

Text in Italian. Canestrini, G. 1869.1;
Doria, G., Ferrari, S. M. & Lessona, M.
1861.1-1869.1.

*Text in Latin. References in Pre-Linn.
section.* Bartholinus, C. 1611.1; Blasius,
G. 1667.1-1681.1; Commelin, C. 1667.1;
Fabri, P. J. 1656.1; Severinus, M. A.
1645.1; Valentini, M. B. 1720.1; Wot-
ton, E. 1552.1.

ANATOMY AND MORPHOLOGY

OF THE FOLLOWING GROUPS OF FISHES

CEPHALOCHORDATA

(The Leptocardii or Lancelets,
marine acraniate chordates.)

General treatises. Cooper, C. F. 1903.1;
★Delage, M. Y. & Hérouard, E. 1898.1;
★Lönnberg, A. J. 1901.5.

Anatomy of Amphioxides,
a pelagic form

Researches. Gibson, H. O. 1910.1;
★Goldschmidt, R. Add. 1905.1.

Anatomy of Amphioxus,
a littoral form

General treatises. ★Burchardt, E.
1900.1; ★Herdman, W. A. 1904.1;
Rohon, J. V. 1882.2; ★Rolph, W.
1875.3; Stieda, L. 1873.1, 3; ★Willey,
A. 1894.1; Thomson, J. A. Add. 1912.2.
*Anatomical-histological researches on the
anatomy of Amphioxus.* Andrews, E. A.
1895.1; Costa, O. G. 1843.2; Filippi, F.
1845.1; Goodsir, J. 1841.2, 1844.1;
Hasse, J. C. 1876.2; Hoeven, J. 1841.2;
Joseph, H. 1900.1, 1902.1; ★Lankester,
E. R. 1875.1, 1889.1; ★Langerhans, P.
1876.2; Marchand, W. 1909.1; Mar-
cusen, J. 1864.2; ★Müller, J. 1841.2;
Neal, H. V. 1915.1; Rathke, M. H.
1841.1; Rice, H. J. 1880.1; Wijhe, J. W.
Add. 1893.1.

Anatomy of Asymmetron,
a littoral form

Andrews, E. A. 1894.1; Morris, E. R.
& Raff, J. 1909.1.

CYCLOSTOMATA

Myxinidæ

*General treatises on anatomy of Myxi-
noids.* ★Cole, F. J. 1905.1, 2; Dean, B.

Anatomy — Cont'd.

(Japanese forms) 1904.7; ★Müller, J. 1834.1, 1843.3.

Anatomy of Myxine. Abildgaard, P. C. 1792.1; Beard, J. 1893.2; Bloch, M. E. 1792.1; Meckel, J. F. 1821.1; Putnam, F. W. 1874.1.

Bdellostomatidæ

Bdellostoma. Ayers, H. 1894.1.

Petromyzontidæ

Anatomy of Ammocetes, the larval form of Petromyzon. ★Julin, C. 1887.6, 1889.1; Quatrefages, J. L. 1849.2; Rathke, M. H. 1827.1 (iii); Schaffer, J. 1895.2; Zhuk, V. 1907.1.

Anatomy of Petromyzon. Born, G. 1827.2, 1828.1; Carus, C. G. 1816.1; Desmoulins, L. A. & Magendie, F. 1822.1; Gulliver, G. 1870.1, 1872.1; ★Langerhans, P. 1873.2, 1876.1; ★Lubosch, W. 1904.3; Nestler, K. 1890.1; Panizza, B. 1843.1, 1845.1, 1846.1; Parker, T. J. 1884.1; ★Rathke, M. H. 1823.1, 1825.1, 1827.1 (iii); Schloesser, G. 1848.1; Walbaum, J. J. Add. 1778.1, 1783.1; Bronzer, J. H. Pre-Linn. 1626.1; Frisch, J. L. Pre-Linn. 1740.4; Waldschmid, W. U. Pre-Linn. 1700.1.

Anatomy of Geotria and Mordacia. ★Woodland, W. N. 1913.2.

PISCES**ELASMOBRANCHII**

Anatomy, especially skull, vertebræ and limbs. Hubrecht, A. A. 1876.3.

For the latest and most complete work on the morphology of the Elasmobranchii, see J. F. Daniel, "The Elasmobranch Fishes." Berkeley, California, 1922. 334 pp., 260 figs., and a full bibliography.

Plagiostomi

Anatomy and morphology of Plagiostomes. Garman, S. 1913.1; Kleberg, O. 1868.1; Müller, J. 1842.3; Müller, J. & Henle, F. 1841.1; Redeke, H. C. 1899.1; Retzius, A. A. 1819.1; Robin, C. P. 1846.6.

Selachii

(including unnamed sharks)

Structural peculiarities of sharks. Costa, O. G. 1857.3; Mitchill, S. L. 1803.1; ★Pavesi, P. 1874.1, 1878.1; Jensen, A. S. Add. 1914.1; Boccone, P. Pre-Linn. 1720.1; Schonevelde, S. A. Pre-Linn. 1624.1.

Anatomy of various sharks. — Selache. Blainville, H. M. 1811.1; Gervais, F. L. & H. F. 1876.1, 1877.1; Home, E. 1809.1, 1813.1; ★Pavesi, P. 1874.1. — *Læmargus.* Burckhardt, C. R. 1900.1; Calderwood, W. L. 1885.1; ★Helbing, H. 1902.1, 1904.1. — *Euprotomicrus.* Cunningham, R. O. 1899.1. — *Chlamydoselachus.* ★Garman, S. 1885.2, 5. — *Squatina (fossil).* Hasse, J. C. 1876.1; ★Wils, H. B. 1844.1. — *Pristiophorus.* ★Jaekel, O. 1891.2. — *Spinax.* ★Jaquet, M. 1897.2. — *Acanthias.* Kingsley, J. S. 1907.1; Griffin, L. E. Add. 1907.1. —

Echinorhinus. Kyle, H. M. 1900.4; Turner, W. 1875.1. — *Alopias (Alopias).* Kneeland, S. 1847.1; Trois, E. F. 1882.1. — *Scymnus.* Kneeland, S. 1847.2; Parker, T. J. 1882.1. — *Carcharodon.* Parker, T. J. 1887.1. — *Squalidæ.* Retzius, A. A. 1819.1; Vrolik, G. 1826.1, 1828.1. — *Centrophorus.* Woodland, W. N. 1906.1. — *Carcharias.* Wyman, J. 1854.3; Haro, A. Add. 1839.1; Boccone, P. Pre-Linn. 1720.1; Kanold, J. Pre-Linn. 1721.1; Steno, N. Pre-Linn. 1667.1. — *Centrina.* Jacobæus, O. Pre-Linn. 1680.1.

Batoidei

Anatomy of Torpedo. Boll, F. 1874.1, 1876.1; Calamai, L. 1845.1; Chiaje, S. delle 1840.1, 2; ★Fritsch, G. T. 1890.1; Hunter, J. 1774.1, Add. 1774.1; Jacobæus, O. Pre-Linn. 1680.2; Ingrams, — Pre-Linn. 1750.1; Kaempfer, E. Pre-Linn. 1720.1; Lorenzini, S. Pre-Linn. 1678.1–1720.1.

Anatomy of Raja. ★Ewart, J. C. & Matthews, J. D. 1885.1; Langguth, G. A. 1774.1, 1776.1; Leydig, F. 1852.1; Metz, C. W. 1912.1; Retzius, A. A. 1819.1; Stephan, M. 1779.1; Moehring, P. H. Pre-Linn. 1742.1; Ruysch, F. Pre-Linn. 1720.1; Steno, N. Pre-Linn. 1664.1.

Disceus and Potamotrygon. Garman, S. 1877.2.

Narcine. Henle, F. G. 1834.1.

Holocephali

General treatises on the morphology of Chimæroid fishes. ★Dean, B. 1906.1; Garman, S. 1904.1.

Anatomy of Chimæra. Hartmann, R. 1876.1; ★Jaquet, M. 1897.2; Mazza, F. 1895.1. — *Callorhynchus.* Jaquet, M. 1897.2; ★Schauinsland, H. H. 1903.1.

DIPNOI

Anatomy of recent forms. ★Ayers, H. 1885.1, 1893.2. — *of Devonian forms.* Watson, D. M. & Day, H. 1916.1.

Morphology of Lepidosiren. Bischoff, T. W. 1840.1, Add. 1840.1; ★Hyrtl, C. J. 1845.1; Lankester, E. R. (*Excellent figure*) 1896.1. — *Ceratodus (Neoceratodus).* Castelnau, F. L. 1876.1; ★Fürbringer, M. 1913.1; Günther, A. 1871.4; Huxley, T. H. (*Fine figure*) 1876.1; Jaquet, M. 1897.2; Margó, T. 1894.1, 2; ★Semon, R. W. 1893.1. — *Protopterus.* ★Jaquet, M. 1897.2; Jardine, W. 1841.1; Klein, E. E. 1864.1; Kölliker, R. A. 1860.1; Lankester, E. R. (*Figure*) 1896.1; Macdonnell, R. 1860.1; ★Owen, R. 1839.1, 2, 1841.1; ★Parker, W. N. 1888.2, 1889.2, 1892.1.

GANOIDEI

Recent forms. Miall, L. C. 1872.1, 1879.1; ★Müller, J. 1844.2, 1845.1, 1846.1, 2. — *Devonian forms.* Watson, D. M. & Day, H. 1916.1.

Anatomy of Lepidosteus. Agassiz, J. L. 1834.5; Wilder, B. G. 1877.1. — *Acipenser.* Craigie, D. 1830.1; ★Kittary,

M. 1850.1; Koelreuter, J. G. 1771.1; Zograf, N. Y. 1887.1, 2; O., D. G. Pre-Linn. 1703.1. — *Scaphirhynchus*. Brutzer, G. G. 1859.1; ★Ivanov, N. 1887.1. — *Polypterus*. ★Budgett, J. S. 1900.4, 5, 1902.1, 2, 1907.1; Geoffroy-Saint-Hilaire, E. F. 1802.2, 3; Leydig, F. 1854.1; ★Pollard, H. B. 1891.1, 2. — *Amia*. Franque, H. 1847.1. — *Polyodon*. Handyside, P. D. 1875.1; Wagner, A. 1848.1. — *Calamoichthys*. Traquair, R. H. 1866.1, 1871.1.

TELEOSTEI

Marine forms. Holt, E. W. 1894.1.

Sub-order Acanthopterygii

Jugulares. — *Anatomy of Ophidium*. Broussonet, P. M. 1781.1; Schelhammer, G. C. Pre-Linn. 1707.1, 1712.2, 1720.1. — *Uranoscopus*. Facciola, L. 1883.1. — *Blenniidae*. Forchhammer, T. 1819.1. *Anarrichadidae*. Gill, T. N. 1911.2.

Kurtiformes. — *Anatomy of Kurtus*. Beaufort, L. F. Add. 1914.1, 2.

Perciformes. — *Anatomy of Sciæna*. Robin, C. P. 1847.3.

Scleroparei. — *Anatomy of Trigla*. Deslongchamps, J. A. 1843.1. — *Cyclopterus*. Faivre, E. 1856.1; Rathke, M. H. 1822.1; Schelhammer, C. C. Pre-Linn. 1707.1, 1712.1, 1720.1; Tyson, E. Pre-Linn. 1686.2. — *Ophidion*. Retzius, A. J. 1833.1. — *Agriopus*. Stenhouse, A. 1894.1.

Scombriformes. — *Anatomy of Xiphias*. Grant, R. E. 1828.1; Koelpin, A. B. 1770.1; Walbaum, J. J. 1789.1; Bartholin, T. Pre-Linn. 1641.1–1678.1; Faber, J. Pre-Linn. 1693.1; Hartmann, P. J. Pre-Linn. 1693.1, 1695.1; Schelhammer, G. C. Pre-Linn. 1707.1. — *Thynnus*. Jurine, L. 1821.1. — *Orcynus (male)*. McIntosh, W. C. 1886.3. — *Luvarus*. Trois, E. F. 1867.2, 1876.3; ★Haller, B. Add. 1881.1.

Tæniosomi. — *Anatomy of Trachypterus*. ★Meek, A. 1890.1; Vayssière, A. 1908.2; Carruccio, A. Add. 1895.1. — *Regalecus*. Powell, L. 1879.1.

Zeorhombi. — *Morphology of Pleuronectidae*. Cole, F. J. 1902.1; Cunningham, J. T. 1902.3; Kyle, H. M. 1900.5; Thilo, O. 1910.1. — *Pleuronectes*. Autenrieth, J. H. F. 1800.1; ★Cole, F. J. & Johnstone, J. 1901.1; Koelreuter, J. G. 1791.1. — *Grammicolepis*. Shufeldt, R. W. 1889.1.

Sub-order Anacanthini

Anatomy of Lotella. Beattie, J. M. 1891.1. — *Gadus*. Koelreuter, J. G. 1769.1; M'Alpine, D. 1881.1; Schagerström, N. O. 1831.1; Guenelloni, —. Pre-Linn. 1686.1. — *Lota*. Hoffmann, M. Pre-Linn. 1722.1.

Sub-order Apodes

Anatomy of Anguilla. Costa, O. G. 1850.2, 1851.2; Ishikawa, C. 1898.1; Lagberg, J. O. 1821.1; Langguth, G. A. 1778.1; Schloesser, G. 1848.1; Mural, J. Pre-Linn. 1688.1; Peyer, J. C. Pre-

Linn. 1688.1. — *Eurypharyngidae*. Gill, T. N. & Ryder, J. A. 1884.3. — *Helmichthys*. Kölliker, R. A. 1853.1, 2. — *Chlopsis*. Supino, F. 1905.1. — *Saurencylys*. Supino, F. 1905.2. — *Todarus*. Supino, F. 1905.3. — *Conger*. Yarrell, W. 1831.2. — *Ophisurus*. Knox, F. J. Add. 1870.1.

Sub-order Catosteomi

Anatomy of Amphisila, Centriscus, and the Aulostomidae. ★Jungersen, H. F. 1908.1. — *Solenostomidae*. ★Jungersen, H. F. 1908.1, 1910.1; Willey, A. 1909.2. — *Syngnathidae*. ★Jungersen, H. F. 1908.1; Noll, F. C. 1879.1. — *Pegasus*. Jungersen, H. F. 1910.1, Add. 1914.1. — *Syngnathus*. Rathke, M. H. 1830.1; Retzius, A. J. 1833.1. — *Hippocampus*. Ryder, J. A. 1882.2.

Sub-order Haplomi

Anatomy of Esox. Giltay, C. M. 1832.1, Add. 1833.1; Needham, W. Pre-Linn. 1720.2. — *Poeciliidae*. ★Langer, W. F. 1913.1. — *Lebias*. Mazza, F. 1897.1. — *Glaridichthys*. Philippi, E. 1908.1. — *Phallostethus*. Regan, C. T. 1913.14.

Sub-order Heteromi

Anatomy of Fierasfer. ★Emery, C. 1880.1, 2; Nusbaum, J. & Bykowski, L. 1904.1, 1905.1.

Sub-order Malacopterygii

Anatomy of Salmonidae. Agassiz, J. L. & Vogt, C. 1845.1. — *Scleropages*. Castelnau, F. L. 1876.1. — *Clupea*. Day, F. 1879.1; Schonevelde, S. A. Pre-Linn. 1624.1; Severinus, M. A. Pre-Linn. 1720.1. — *Gymnarchus*. Erdl, M. P. 1846.2, 3; Fritsch, G. T. 1885.1; Hyrtl, C. J. 1856.1. — *Sternoptixinae*. Handyside, P. D. 1839.1. — *Heterotis*. Hyrtl, C. J. 1854.1. — *Mormyrus*. Hyrtl, C. J. 1856.1, Add. 1849.1, 1850.1; ★Marcusen, J. 1853.1, 1854.2, 1864.1. — *Coregonus*. Koelreuter, J. G. 1770.2, 1773.1. — *Cyclothone*. Nusbaum, J. 1912.1. — *Clupanodon*. Taylor, J. 1831.2, 1835.1.

Sub-order Ostariophysii

Characinidae. — *General treatise on anatomy of Characins*. Müller, J. & Troschel, F. 1845.1. — *Visceral anatomy*. Rowntree, W. S. 1903.1.

Cyprinidae. — *Anatomy of Tinca*. ★Andres, A. 1899.1. — *Leuciscus*. Ayres, W. O. 1848.3. — *Cyprinus*. Gaspard, B. 1828.1, 1830.1; Koelreuter, J. G. 1770.1; Steno, N. Pre-Linn. 1673.1. — *Carassius*. Hirsch, J. 1912.1. — *Misgurnus*. Rougemont, P. A. 1875.1, 1876.1.

Gymnotidae. — *Anatomy of Gymnotus*. ★Ballowitz, E. 1897.4; Chiaje, S. delle 1848.1; Cleland, J. 1886.3; Knox, R. 1824.1; Letheby, H. 1843.1, 2; ★Sachs, C. 1877.1, 2; Valentin, G. G. 1842.1.

Loricariidae. — *General account of anatomy of Loricariidae*. ★Rauther, M. 1911.1. — *Rhinelepis*. Carruccio, A. 1903.1. — *Hypostomus*. ★Weyenbergh, H. 1878.3.

Siluridae. — *Anatomy of Malapterurus*.

Anatomy—*Cont'd.*

Cleland, J. 1858.1; ★Fritsch, G. T. 1886.5, 1887.1; Goodsir, J. 1858.1. — *Claroetes*. Hyrtl, C. J. 1858.2, 1859.1. — *Saccobranchus*. Hyrtl, C. J. 1854.4; ★Pape, C. 1914.1. — *Silurus glanis*. ★Jaquet, M. 1898.1, 2; Hartmann, P. J. Pre-Linn, 1688.1; Schonevelde, S. A. Pre-Linn. 1624.1. — *S. batrachus*. Taylor, J. 1831.2, 1835.1. — *Ameiurus*. Macalium, A. B. Add. 1884.1.

Sub-order Pediculati

Anatomy of Lophius. Ent, G. Pre-Linn. 1668.1; Koenig, E. Pre-Linn. 1695.1.

Sub-order Percesoces

Anatomy of Hemiramphus. Dieckmann, P. 1904.1. — *Mugil*. Knox, F. J. 1872.1. *Tetragonurus*. ★Mettenheimer, C. F. 1854.1. — *Centrolophus*. Rennie, J. 1907.1. — *Coius* and *Ophiocephalus*. Taylor, J. 1831.2, 1835.1. — *Anabantidae*. Brüning, C. Add. 1914.1.

Sub-order Plectognathi

General treatise on anatomy of the Plectognaths. ★Kaschkaroff, D. N. Add. 1914.1. — *Mola (Orthogoriscus)*. Agassiz, L. 1856.5; ★Andersson, L. G. 1900.1; Beauregard, H. 1893.1; Cleland, J. 1862.1; Goodsir, J. 1841.1, 1868.1; Harting, P. 1865.3; Jourdain, S. 1871.1; Parker, T. J. 1897.1; Wahlgren, F. 1867.1; Wellenbergh, P. H. 1840.1; Barlow, W. Pre-Linn. 1744.1; Bartholinus, T. Pre-Linn. 1654.1. — *Ranzania*. Trois, E. F. 1884.1.

ANGLING

For specific methods of fishing, such as use of Cormorant, Explosives, Kite-fishing, etc., as well as methods peculiar to natives of various regions, see section on Fishing Methods.

GENERAL TREATISES

Text in Dutch. *Earliest known work on angling*. Anon. 719. — *For an English translation, see Denison, A. 1872.1.*

Text in English. Bowlker, R. 1758.1; ★Cholmondeley-Pennell, H. 1886.2; Cox, I. E. 1866.1, 2, 1868.1; Henshall, J. A. 1908.1; Holder, C. F. 1897.1, 1910.3, 1913.1; Hopkins, P. 1873.1; Hutchinson, H. G. 1904.1; ★Rhead, L. 1908.1; Schreiner, W. H. 1841.1; Taylor, S. 1800.1; Buxton, S. Add. 1902.1. — *"The compleat angler."* ★Walton, I. 1759.1, 1893.1. — *Reprint of Mascall, L.* Pre-Linn. 1590.1. Satchell, T. 1884.1.

Guides, handbooks, reference works, etc. Alexander, T. 1879.1; Davies, G. C. 1873.1; Fitzgibbon, E. 1847.1; Herbert, H. W. 1849.1, 1850.1, 1864.1; Smith, G. 1799.1; Hallock, C. Add. 1873.1; Williamson, T. Add. 1825.1.

Halieutics or anecdotes, narratives, etc. Aflalo, F. G. 1905.2; Badham, C. D. 1854.1; Boosey, T. 1887.1; Buckland, F. T. 1875.1, 1876.1, 1882.1; Martin, J. W. 1910.1; Anon. 284; Dawson, G. Add. 1883.1; Durnford, R. Add. 1911.1; Davy, J. Add. 1855.1.

American works, with special reference to Canada and the United States. Bradford, C. B. 1908.1; Forester, F. 1856.1; Norris, T. 1864.1, 1865.1; Penn, R. 1868.1; Roosevelt, R. B. & Green, S. 1879.1, 1885.1; Anon. 35; Brown, J. J. Add. 1876.1; Camp, S. G. Add. 1911.1; Foster, D. Add. 1883.1.

British works, relating primarily to the British Isles. Keene, J. H. 1881.5; Salter, T. F. 1814.1, 1820.1, Add. 1841.1, 2; Shipley, W. 1838.1; Hofland, T. C. Add. 1839.1.

Text in French. Poitevin, M. B. 1897.1; Albert-Petit, — & others. Add. 1901.1; Bastien, J. F. Add. 1798.1; Fisher, J. Add. 1909.1; La Blanchère, P. Add. 1881.1; Pesson-M. — & Paulin, — Add. 1864.1; Pigoreau, C. B. Add. 1828.1; Gamon, C. Pre-Linn. 1599.1.

Text in German. Bischoff, W. 1864.1, Add. 1908.1; ★Borne, M. 1875.2, 1877.3, 1904.2, Add. 1914.1; Ehrenkreutz, — 1864.1; Heintz, K. 1911.1; Mörbe, J. 1902.1; Tung, A. 1911.1; Anon. 633; Alquen, F. L. Add. 1862.1.

Bibliographies and catalogues of angling literature. (See also section on Bibliographies.) Bethune, G. W. 1847.1; Burn, J. H. 1820.1; Ellis, H. 1811.1; Fearing, D. B. 1911.1; Kybitz, C. W. 1893.1; Marston, R. B. 1901.1; Pickering, W. 1836.1; ★Westwood, T. & Satchell, T. 1883.1; Bohn, J. Add. 1835.1.

Bibliographies and catalogues of special collections. — *Catalogue of the Bartlett collection.* Albee, L. R. 1891.1. — *Catalogue of library of W. Booth.* Booth, W. 1884.1. — *Catalogues of the Waltonian library of R. W. Coleman.* Coleman, R. W. 1866.1, 1897.1; Sabin, J. 1866.1. — *The bibliography of Izaak Walton's "Compleat Angler."* Satchell, T. 1882.1. — *Catalogue of English writers on angling, etc.* Smith, John Russell, 1856.1.

HISTORICAL MATTER

Historical sketches of the angling literature of all nations. Blakey, R. 1856.1. — *English trans. of Anon. 719; the earliest work on angling.* Denison, A. 1872.1. — *Notes on the Book of Saint Albans.* Haslewood, J. 1810.1, 1816.1. — *Angling literature in England.* Lambert, O. 1881.1–1883.2.

Notes on early angling authors. Marston, R. B. 1894.1; Turrell, W. J. 1910.1.

Pre-Linnæan Treatises, Accounts, etc.

General treatises. *Text in English.* Barker, T. 1657.1; ★Barnes, J. 1496.1; Brookes, R. 1740.1; Chetham, J. 1681.1; ★Dennys, J. 1613.1; Moore, J. 1721.1; S., J. 1696.1; Saunders, J. 1724.1; Venables, R. 1662.1. — *Oldest English treatises on fishing.* Aelfric. 990; Piers of Fulham, 1420.1. — *The complete troller.* Nobbes, R. 1682.1. — *The British angler.* Williamson, J. 1740.1.

Text in French. ★Fortin, P. 1660.1; Liger, L. 1700.1–1743.1.

Text in German. Steinbock, E. F. 1730.1.

Books on husbandry. Anon. 725, 744, 749, 758, 765, 766, 767, 779, 780, 784, 785, 786; Ascham, A. 1549.1; Blagrave, J. 1669.1; Blome, R. 1686.1; Colerus, J. 1656.1; ★Cox, N. 1674.1; Ellis, W. 1750.1; Gauchet, C. D. 1583.1; Grandi, L. 1667.1; H., R. 1684.1; Heller, J. 1582.1; Heppe, C. W. 1753.1, ★Heresbach, C. 1570.1–1658.1; Hildebrand, W. 1664.1; Jacob, G. 1717.1–1740.1; Markham, G. 1614.1; Paciersio, G. 1669.1; Platt, H. 1594.1; Selincourt, J. E. 1711.1; Sincerus, A. 1720.1; Worlidge, J. 1669.1.

Early laws pertaining to angling. Bossow, P. 1618.1; Bruckmann, F. 1605.1; Fritsch, A. 1702.1; Henchelin, C. 1599.1; Isachius, A. 1570.1; Koleffel, M. J. 1684.1; Medices, S. 1586.1; Mor de Nigro Monte, G. 1602.1; Ninmero, J. 1604.1.

Dictionaries and encyclopædias. Comenius, J. A. 1639.1; Curzon, H. 1712.1; La Chesnaye Desbois, F. 1751.1; Noël, — 1737.1; Smith, G. 1754.1.

Guides, handbooks, etc. G., C. 1705.1; Hartenfels, G. C. 1691.1; Holst, G. 1649.1; Howlett, R. 1700.1; Wright, W. 1740.1.

"Piscatory eclogues," halieutics, etc. Giannettasius, N. P. 1685.1, 1686.1; Gilbert, W. 1676.1; Sannazaro, J. 1526.2; Vorstius, D. C. 1613.1.

FLY-FISHING

General treatises. Halford, F. M. 1813.1, 1886.1; Horrocks, — 1874.1; Orvis, C. F. & Cheney, A. N. 1883.1; Ronalds, A. 1836.1; ★Shaw, F. G. 1914.1; Shipley, W. 1838.1.

Pre-Linn. refs. Bowlker, R. 1746.1; Fournival, R. 1470.1; Keill, J. 1729.1; — *First writer to mention use of artificial fly.* Ælian, C. 1533.1.

Shorter papers on use of the fly. Baird, S. F. 1871.46; Bowlker, C. 1758.1, 1774.1; Cairncross, D. 1862.1; Cartwright, W. 1854.1; Roosevelt, R. B. 1865.1, 2, 1884.1, 2; Tod, E. M. 1909.1 (*wet*); Camp, S. G. Add. 1913.1; Hamilton, E. Add. 1885.1; La Branche, G. M. Add. 1914.1; Massas, C. Add. 1861.1; Pulman, G. P. Add. 1851.1; Ronalds, A. Add. 1883.1.

SEA FISHING

General treatises. ★Bickerdyke, J. 1895.1; Paske, C. T. & Aflalo, F. G. 1892.1; Young, L. J. 1865.1, 1872.1; Haslope, P. L. Add. 1905.1; ★Holder, C. F. Add. 1914.2.

Various short articles. Lister, J. L. 1879.1; Lord, W. B. 1862.1, 1863.1; Anon. 49; Hudson, F. Add. 1888.1.

ANGLING FOR SALMON AND TROUT

General treatises. Fitzgibbon, E. & Young, A. 1850.1; Russell, H. 1911.1; Schubart, A. 1907.1; Wells, H. P. 1886.1, 2; Younger, J. 1860.1, Add. 1864.1;

Clarke, K. Add. 1889.1; ★Hardy, J. J. Add. 1907.1; Hodgson, W. Add. 1904.1, 1906.1, 1907.1; Cotton, C. Pre-Linn. 1676.1.

Short popular articles. Baird, S. F. 1871.38, 1873.45; Barrington, C. G. 1906.1; Barton, E. L. 1900.1; Bennett, T. 1874.1; Cartwright, W. 1874.1; Conway, J. 1861.1; Herbert, H. W. 1853.1; Hutchinson, H. G. 1904.1; Matthey, A. 1883.1; Armistead, W. H. Add. 1908.1; Dawson, G. Add. 1876.1; Hallock, C. Add. 1890.1; Stewart, W. C. Add. 1877.1; Wilkinson, A. G. Add. 1883.1.

Salmon and trout fishing in the British Isles, chiefly Scotland. Ayrton, W. 1853.1; Bertram, J. G. 1889.1, 1890.1; Gallichan, W. M. 1908.1; Grimble, A. 1904.1, Add. 1913.1; Harvie-Brown, J. A. 1899.1, 1901.1, 2, 1902.3; Hector, A. 1861.1; Knox, A. E. 1872.1; Muirhead, G. 1903.1; Serope, W. 1843.1; Stirling, J. 1883.2; Watson, W. J. 1910.1; Matson, W. J. Add. 1910.1.

Salmon and trout fishing in North America. — *Salmon fishing in Canada.* Adamson, W. A. 1860.1; Alexander, J. E. 1849.1–1860.1; Nettle, R. 1857.1; Roosevelt, R. B. 1865.1, 1884.1; ★Sage, D. 1888.1.

In the United States. Buncombe, — 1874.1; Sage, D., Townsend, C. H., Smith, H. M. & Harris, W. C. 1902.1; Townsend, J. K. 1839.1, 1840.1; Seymour, E. Add. 1883.1.

ANGLING FOR VARIOUS FISHES

Angling for pike, pickerel, and muskallonge. Chalmers, T. 1879.4; Hutchinson, H. G. 1904.1; ★Martin, J. W. 1910.2; Pfundheller, J. 1880.1; ★Senior, W. 1900.1; Pyle, H. Add. 1883.1.

Tarpon fishing. Harmsworth, A. C. 1895.1; Turner-Turner, J. 1902.1; Churchill, E. G. Add. 1907.1; ★Dimock, A. W. Add. 1911.1. — *Megalops cyprinoides as a fly-taker.* Wallinger, W. A. 1904.1.

Angling for tuna. Holder, C. F. 1911.1; Osburn, R. C. 1910.4; Poussielgue, E. 1874; Lambert, T. W. Add. 1907.1.

Various other angling papers. — *Grayling.* Dawson, G. 1878.1; Pritt, T. E. 1888.1. — *Lutianus synagris.* Garcia Canizares, F. 1911.1. — *Black bass.* Henshall, J. A. 1881.1, 1904.2. — *Smelt (Osmerus).* McLellan, I. 1874.2. — *Perch.* Martin, J. W. 1910.2; Senior, W. 1900.1. — *Striped bass, (Roccus lineatus).* Roosevelt, R. B. 1865.2, 1884.2; Worth, S. G. 1912.1. — *Roach.* Wix, H. 1860.1.

ANGLING BY REGIONS

North America. *Alaska.* Beardslee, L. 1879.1; Schwatka, F. 1885.1.

Canada. D., C. U. 1874.1; Gregory, J. U. 1873.1; Hardy, C. 1869.1; King, W. R. 1866.1; Philips, B. 1874.7; Burroughs, J. Add. 1883.1.

United States. Bean, T. H. 1890.13; Dinsmore, A. H. 1902.1; Holder, C. F. 1908.6; Locke, W. M. 1878.1; Weidmayer, M. C. 1885.1; Gregg, W. H. Add.

Angling — *Cont'd.*

1902.1; Harris, W. C. Add. 1885.1; Muller, J. W. Add. 1909.1; Northrup, A. J. Add. 1903.1; Vachell, H. A. Add. 1901.1. — *History of the Schuylkill Fishing Company, Philadelphia.* Milnor, W. 1830.1, 1889.1.

Europe. *British Isles.* Cox, I. E. 1877.1; Drayton, M. Pre-Linn. 1613.1. — *England.* Davy, J. 1857.1 (*Lake district*); Huegel, A. 1870.1; Blakey, R. Add. 1859.1; Cornish, C. J. Add. 1902.1; Dewar, G. A. Add. 1899.1. *Angling clubs.* Wheeldon, J. P. 1883.1; Anon. 52. — *Ireland.* Hi-Regan 1887.1. — *Scotland.* Hicks, J. 1855.1; Blakey, R. Add. 1859.2; Colquhoun, J. Add. 1841.1; MacVine, J. Add. 1891.1; Stoddart, T. T. Add. 1836.1, 1864.1; Frank, R. Pre-Linn. 1694.1. — *Wales.* Anon. 53.

France. Henriques, J. 1775.1; Dax, L. Add. 1860.1; Kresz, C. Add. 1847.1.

Germany. — *Tegernsee.* Stölzle, A. Add. 1912.1. — *Bodensee.* Mangolt, G. Pre-Linn. 1520.1.

Luxembourg. Faber, E. Add. 1913.1.

Russia. Grimm, O. Add. 1883.1.

Scandinavia. Hintze, A. 1894.1.

Other localities. — *Australia.* Aflalo, F. G. 1896.1.

India. Aflalo, F. G. 1904.4; Thomas, H. S. 1873.1, 1881.1; Wallinger, W. A. 1904.1; Skene Dhu Add. 1906.1.

Mexico, Guaymas. Climax 1881.1.

South America. — *Chile.* Mullen, W. 1874.1. — *Brazil.* Luccock, J. Add. 1820.1.

AQUARIA

For papers on particular aquarium fishes, see the following section.

Miscellaneous papers on the management and care of aquaria. Bettziech, J. 1868.1; Deister, G. 1880.1; Emeljanenko, P. E. 1908.1; Pellegrin, J. 1910.2; Reitmayer, C. A. 1914.1; Spencer, L. B. 1900.1, 1903.1; Stansch, K. 1910.1; Vaillant, L. L. 1892.1; Zerneck, E. 1897.1. — *Heating aquaria.* Brüning, C. 1910.4; Schlieper, G. 1914.1; Supino, F. 1908.5. — *Plants in aquaria.* Humphreys, H. N. 1857.1; Schermer, E. 1915.1. — *Aerating aquaria.* Zirzow, P. 1906.1; Newman, E. Add. 1875.1.

General treatises on the management of aquaria. *Text in — French.* Coupin, H. 1893.1; Pizzetta, J. 1872.1. — *Danish.* Gundel, E. V. 1888.1. — *Dutch.* Kerbert, C. 1888.1; Roszmazler, E. A. 1872.1. — *Italian.* Lessona, M. 1864.1.

Text in English. Bateman, G. C. 1890.1; Bateman, G. & Bennett, R. 1902.1; Butler, H. D. 1858.1; Edwards, A. M. 1858.1; ★Eggeling, O. & Ehrenberg, F. 1908.1; Gosse, P. H. 1856.1; Jones, T. Rymer, 1858.1, 1868.1; Lankester, E. 1856.1; Leach, F. S. 1856.1; Lloyd, W. A. 1876.1; ★Osburn, R. C. 1912.1, 1914.1; Reed, C. A. 1908.1; Seal, W. P. 1885.1, 1889.1, 2; Tappan, F. L. 1911.1; ★Wolff,

H. T. 1909.1; Wood, J. G. 1867.1; Collier, J. H. & Hooper, J. Add. 1866.1; Samuels, M. Add. 1894.1; ★Smith, E. Add. 1902.1; ★Taylor, J. E. Add. 1901.1. *Text in German.* ★Bade, E. 1896.1, 1907.2, 1909.1, 1911.1, 2, 1912.1; Brehm, A. E. 1869.2; Duerigen, B. 1897.1; Graeffe, E. 1861.1; ★Leonhardt, E. E. 1907.1, 1908.3, 4; Nitsche, P. 1901.1; Reuter, F. & Wolterstorff, W. 1912.1; Roszmazler, E. A. 1869.1, Add. 1880.1; Roth, W. (*Diseases*) 1912.1; Heller, C. Add. 1914.1; Henkel, F., Baum, H. & Stansch, K. Add. 1907.1; Jaeger, G. Add. 1913.1.

Marine aquaria. *General treatises in English.* Hibberd, J. S. 1856.1, 1860.1; Lankester, E. 1856.1; Humphreys, H. N. Add. 1857.1. — *in German.* ★Müllegger, S. 1909.1, 1910.1.

Miscellaneous papers. Müllauer, M. 1901.1; Wolff, H. T. 1909.1; Wood, J. C. 1867.1. — *Artificial sea water for aquaria.* Hoffman, R. E. 1884.1.

PRINCIPAL AQUARIA**Of the world**

For aquaria maintained by the principal biological stations, see *Stations & Laboratories, under Fisheries.*

List of fishes exhibited at Giza, Egypt. Flower, S. S. 1904.1, 1910.1. — *Management of public aquaria.* Mather, F. 1880.1. — *Aquarium in Australia.* Stead, D. G. 1911.1.

European aquaria. Blake, W. P. 1884.1; Dean, B. 1896.8; Townsend, C. H. Add. 1914.3.

British Isles, England. — *Brighton Aquarium.* Francis, F. 1872.1; Goldsmith, M. 1874.1; Kent, W. S. 1873.2; Anon. 339. — *London: Crystal Palace.* Birchall, E. H. 1876.1; Vouga, P. 1872.1. — *London, Zool. Garden Aquarium.* Valmer, —. 1856.1; Holdsworth, E. W. Add. 1860.1. — *Westminster, Royal Aquarium.* Lloyd, W. A. Add. 1875.1.

France, Paris, Trocadéro Aquarium. Bellesme, J. 1886.1; Carbonnier, P. 1879.1. — *Jardin des Plantes.* Lemaout, E. 1843.1; Oken, L. 1823.1. — *Aquarium of the Jardin d'acclimatation.* Rufz de Lavison, E. 1863.1. — *Boulogne-sur-Mer, Aquarium of International exposition.* Magnier, E. 1866.1. — *Le Havre Aquarium.* Beaugrand, C. Add. 1884.1.

Germany. Berlin Aquarium. Blaauw, F. E. 1900.1; Brehm, A. E. 1869.1, 1871.1; Schlömp, V. 1914.1. — *Hamburg; Aquarium of the zoological gardens.* Bolau, C. 1878.1; Fischer, J. G. 1885.1; Möbius, K. A. Add. 1864.1. — *Frankfurt-a.-M., Zoological gardens.* Schreitmüller, W. 1915.12.

Netherlands. Amsterdam Aquarium. Pellegrin, J. 1909.1.

Portugal, Lisbon. Aquaria Vasco da Gama. Seabra, A. F. 1910.1.

Aquaria of the United States. *California, Los Angeles.* Edwards, C. L. 1912.1.

— *San Francisco. Woodward's Aquarium.* S., O. 1877.1.

Massachusetts, Boston. Gray, A. F. 1875.1.

The New York Aquarium. Bean, T. H. 1897.2, 1898.2; Bristol, C. L. 1901.1, 1903.1; C., A. P. 1877.1; H., F. 1876.1; Mowbray, L. L. 1910.1; Osburn, R. C. 1910.1, 2, 1911.7, 8, 1912.4; Shufeldt, R. W. 1901.4, 1903.5, 1907.3, 1915.1; ★ Townsend, C. H. 1903.1, 1905.1, 1906.2.

U. S. Fish Comm. Aquarium, Washington. Reeves, I. S. 1894.1; Seal, W. P. 1892.1; Shufeldt, R. W. 1897.2, 1899.1.

AQUARIUM FISHES

This section primarily contains references to the fishes which are commonly kept in aquaria, and to those rare or uncommon species which have occasionally been introduced from foreign lands and exhibited in aquaria.

Many of these papers are merely notices of the exhibition of certain species; others in addition contain remarks on their appearance, their habits while under observation, their nesting or breeding habits, etc.

In no nation has there been developed a greater interest in aquarium fishes than in Germany. The great majority of the following references have appeared in the German aquarium journals. Among these, especial mention may be made of the "*Wochenschrift*" and the "*Blätter für Aquarien und Terrarienkunde*."

Many species of fishes have been introduced in various countries for the purpose of acclimatization. For these, see Introduction and acclimatization under Pisciculture.

For the care of fishes in ponds, see Pond Culture under Pisciculture.

For a comprehensive general work on aquarium fishes, comprising the majority of those listed herein, see *Bibliothek für Aquarien- und Terrarienkunde*, Braunschweig, 1908-14, Heft. 1-37.

CYCLOSTOMATA

Petromyzon. Kammerer, P. 1905.1; Kuhlmann, W. 1912.1; Reese, A. M. 1900.1; Schreitmüller, W. 1909.2, 1911.2; Vieira, L. 1895.1.

DIPNOI

Ceratodus. Dean, B. 1906.2, 1912.2; O'Connor, D. 1898.1, 2; Ramsay, E. P. 1871.1, 1876.1; Slater, P. L. 1898.1, 1906.1; Semon, R. W. 1908.1.

Lepidosiren. Bartlett, A. D. 1856.1; Goeldi, E. A. 1898.3; Meerwarth, H. 1897.1; Müller, F. 1877.1; Wilson, F. W. 1867.1.

Protopterus. Bolau, C. C. 1910.1; Bräunle, E. 1911.1; Duméril, A. H. 1866.5; Gray, J. E. 1856.1; Harting, P. 1858.1; Krauss, F. 1864.1; Lachmann, H. 1891.1; Marno, E. 1873.1; Shufeldt, R. W. 1901.1; Dean, B. Add. 1913.1.

ELASMOBRANCHII

Torpedo in Berlin aquarium. Du Bois-Reymond, E. H. 1884.1.

For other *Elasmobranchii* in aquaria, see under Spawning in section on Reproduction.

GANOIDEI

Acipenser. Baird, S. F. 1874.23; Kammerer, P. 1907.7; Solotnizky, N. F. 1901.2; Zolotniskii, N. F. 1902.3.

Amia. Bade, E. 1898.1, 1902.1; Haffner, C. 1912.3; Hesdörffer, M. 1901.1; Sprenger, W. 1901.1.

Calamoichthys. Jürgens, W. Add. 1906.1.

Lepidosteus. Bade, E. 1899.5; Schreitmüller, W. 1915.10.

TELEOSTEI

Acanthopterygii

Blenniidae

Blenniidae in general. Emeljanenko, P. E. 1909.3. — *Blennius.* Kammerer, P. 1903.1; McIntosh, W. C. 1906.2; Rembold, R. 1909.1, Add. 1906.1; Rheinhold, R. 1906.1.

Centrarchidae

For an extensive account of Centrarchid fishes in aquaria, see ★Engmann, P. 1911.2.

Centrarchidae in general. Marsson, M. 1897.1.

Acantharchus. Mayer, F. 1912.1.

Apomotis. Milewski, A. 1915.1; Schreitmüller, W. 1913.1.

Ambloplites. Schreitmüller, W. 1912.15.

Centrarchus. Engmann, P. 1908.1; Finck, M. C. 1911.4; Holtzsche, P. 1910.1.

Enneacanthus. Bade, E. 1898.2; Bernhard, P. 1914.1; Brüning, C. 1910.3; Finck, M. C. 1913.1; Jüngling, R. 1909.1; Liebig, T. 1910.1; Pajeken, E. E. 1915.2; Weltner, W. 1897.1.

Eupomotis. Stansch, K. 1911.11.

Lepomis. Abbott, C. C. 1875.2; Bade, E. 1899.6; Sprenger, W. 1903.1. —

Mesogonistius. Arnold, J. P. 1902.1; Bade, E. 1898.7; Emeljanenko, P. E. 1906.1; Mädell, H. 1915.1; Milewski, A. 1910.2, 1911.1, 1913.6; Reitz, A. 1907.1; Schaeffer, W. 1904.1; Schubert, F. 1914.1; Stansch, K. 1911.7; Brand, E. Add. 1914.1; Brückner, W. Add. 1914.1; Engmann, P. Add. 1911.2; Krattschmar, A. Add. 1914.1.

Pomoxis. Debschitz, H. 1898.1; Jürgens, W. 1901.1; Sprenger, W. 1900.2; Wendt, A. 1915.2.

Chaetodontidae

Chaetodon. Müllegger, S. Add. 1906.1.

Scatophagus. Arnold, J. P. 1912.26; Beuerle, G. 1912.1; Krüger, B. 1910.1; Scholz, E. J. 1911.1; Träger-Klotsche, G. 1911.8; Visser, C. 1912.1; Conn, C. Add. 1914.5.

Cichlidae

For the best general work on Cichlids as aquarium fishes, see Engmann, P. 1911.1.

General accounts. Conn, C. 1913.1; ★Engmann, P. 1909.5, Add. 1911.1;

Aquarium Fishes — Cont'd.

Gondermann, K. 1912.1; Klapproth, A. 1909.1; Milewski, A. 1915.5; Osburn, R. C. 1910.2; Pellegrin, J. 1906.3.

Acara. Angermann, T. 1908.1; Arnold, J. P. 1911.2, 3; Conn, C. 1913.2; Engmann, P. 1907.1; Geidies, H. 1913.1; Haas, H. J. 1908.3; Hartwig, W. 1908.2; Hippus, K. 1908.1; Höptner, F. 1913.2; Hohmann, K. 1912.1; Hopyner, F. 1913.1; Kurze, R. 1909.1; Leonhardt, E. E. 1906.1; Milewski, A. 1912.1, 1913.1; Meier, A. 1915.1; Muhl, K. 1913.1; Stang, C. 1913.1; Stansch, K. 1915.1; Thumm, J. 1907.1, 1912.1; Ullmann, K. 1909.1; Aubry, O. Add. 1914.1.

Cichla. Rachow, A. 1913.4.

Cichlasoma. Arnold, J. P. 1911.7, 1913.3–1913.6, Add. 1914.2; Aubry, O. 1913.1; Borchardt, F. 1913.1; Krüger, B. 1912.2; Rachow, A. 1912.2, 3, 1914.3; Reitz, A. 1911.2; Reuter, F. 1914.1; Schultheis, H. 1909.1; Stang, C. 1913.1; Höpfner, F. Add. 1914.1.

Crenicichla. Marré, E. 1911.1; Rachow, A. 1912.4, 1913.6; Brüning, C. Add. 1914.8.

Etroplus. Hohmann, K. 1913.1; Mazatis, F. 1910.1; Reichelt, J. 1906.3; Stang, C. 1913.1; Zimmermann, —. 1911.1.

Geophagus. Arnold, J. P. 1911.14; Bade, E. 1899.3; Engmann, P. 1901.3; Heynhold, P. 1910.1, 1912.1; Liebig, T. 1909.1; Liebscher, A. 1901.3; Marré, E. 1909.1; Matte, P. 1901.1; Rachow, A. 1913.4; Schreitmüller, W. 1909.3; Schroot, W. 1902.1; Schultheis, H. 1909.2; Semmer, A. 1902.1; Thumm, J. 1907.2.

Haplochromis. Liebig, T. 1912.3; Reuter, F. 1912.3; Schreitmüller, W. 1912.7.

Hemichromis. Engmann, P. 1909.2; Grohmann, J. 1909.2; Hippus, K. 1909.2; Hoepfel, F. 1913.1; Krüger, B. 1913.5; Meissner, L. 1910.1; Stang, C. 1913.1; Stollreither, A. 1913.1; Schröder, W. Add. 1906.2.

Heros. Arnold, J. P. 1911.17, 1913.6; Bade, E. 1899.1; Finck, M. C. 1911.2; Melnikov, V. S. 1902.1; Schmidt, W. 1903.1; Steglich, E. 1912.1; Zimmermann, —. 1907.1; Engmann, P. Add. 1911.1; Liebig, T. Add. 1914.1.

Heterogramma. Arnold, J. P. 1909.2, 1910.2, 1913.14; Dreyzehner, —. 1912.1; Marré, E. 1909.1; Merwar, L. 1913.1; Schulze, L. 1912.1.

Mesonauta. Grabau, H. 1912.1; Meier, A. 1915.1; Muhl, K. 1913.1; Stansch, K. 1912.2; Weinhausen, H. 1911.2.

Nannocara. Arnold, J. P. 1912.16.

Neetroplus. Hesdörffer, M. 1902.1; Köhler, W. 1905.1.

Paratilapia. Ehnle, H. 1910.6; Geidies, H. 1912.1; Huckfeldt, G. P. 1904.1; Stettner, P. 1906.1; Klinge, W. Add. 1914.1.

Pelmatochromis. Arnold, J. P. 1912.18, 19, 1913.15, 16, Add. 1914.12; Dreyzehner, —. 1911.1, 1912.2; Thumm, J. 1909.3; Träber-Klotsche, G. 1911.6.

Pterophyllum. Arnold, J. P. 1911.23, Add. 1914.17; Eimecke, W. 1912.1; Maas, K. 1913.1; Rachow, A. 1912.13; Taenzer, R. 1914.1; Visser, C. 1912.1; Conn, C. Add. 1914.2, 4; Evancar, J. Add. 1914.2; Osburn, R. C. Add. 1914.3.

Tilapia. Arnold, J. P. 1912.28, 1913.21, Add. 1914.14; Nicolai, E. 1910.2; Rachow, A. 1911.15; Schreitmüller, W. 1911.9; Schütz, R. 1912.3.

Uaru. Arnold, J. P. 1913.22.

Cottidæ

Cottus. Bade, E. 1899.4; Becker, K. 1909.1; Duncker, G. 1891.1; Fraenkel, F. 1913.1; Kammerer, P. 1907.4; Reitmayer, C. A. 1911.3; Schulze, L. 1910.1.

Gobiidæ

Boleophthalmus. Reichelt, J. 1910.1; Rodewald, C. 1913.1; Schreitmüller, W. 1910.4, 1911.5, 1914.3.

Dormitor. Mikolay, A. 1909.1; Rachow, A. 1913.8; Reuter, F. 1911.1.

Eleotris. Arnold, J. P. 1911.10, 1913.9, 10; Brüning, C. 1902.1; Reichelt, J. 1906.2; Reuter, F. 1913.1, 1914.4; Schreitmüller, W. 1913.3, 1915.8; Schröder, W. Add. 1906.1.

Evorthodus. Arnold, J. P. 1912.8.

Gobius. Gienke, H. 1912.1; Reichelt, J. 1906.5; Schermer, E. 1915.2; Schreitmüller, W. 1910.4; Solotnizky, N. F. 1901.1; Arnold, J. P. Add. 1914.7.

Periophthalmus. Arnold, J. P. 1908.3; Reichelt, J. 1910.1; Schreitmüller, W. 1914.5.

Nandidæ

General account. Arnold, J. P. 1912.9.

Badis. Emeljanenko, P. E. 1907.2; Lauppe, L. 1907.1; Leonhardt, E. E. 1906.2; Osswald, H. 1913.1; Pittrich, B. 1907.1; Potempa, A. 1911.1; Schreitmüller, W. 1915.4; Stansch, K. Add. 1906.1.

Monocirrus. Krüger, B. 1913.4; Milewski, A. 1914.2, 8; Reuter, F. 1913.2; Stansch, K. 1913.4.

Nandus. Reuter, F. 1913.3.

Polycentropsis. Arnold, J. P. 1906.3, 1908.2, 1912.22; Brand, F. N. 1910.1; Krasper, E. Add. 1914.1.

Polycentrus. Arnold, J. P. 1909.7, 1910.3; Engmann, P. 1910.1; Osswald, H. 1913.4; Pfeiffer, K. 1910.1; Schulze, L. 1912.2; Siedentopf, O. 1915.1; Unterberg, J. 1915.2; Geides, H. Add. 1914.1.

Osphromenidæ

For the most comprehensive work on Macropodes in aquaria, see Stansch, K. 1907.1.

Betta pugnax (the fighting fish of Siam). Arnold, J. P. 1904.2; Bade, E. 1898.3; Bause, B. 1897.1; Braun, J. O. 1908.1;

Braunschweig, K. 1910.1; Butscher, A. 1901.1; Carbonnier, P. 1874.2; Dobelmann-Degerloch, H. 1899.1; Hipler, J. 1913.1, 2, Add. 1914.1; Hoffmann, E. 1913.1; Jürss, H. 1911.1; Krüger, Alfred, 1912.1; Liebig, T. 1912.2; Milewski, A. 1915.10; Noetzel, T. 1898.2; Pittrich, B. 1907.2; Rachow, A. 1914.7; Regan, C. T. 1910.3; Reuter, F. 1911.2; Schäfer, K. 1913.1; Träber-Klotsche, G. 1912.4; Anon. 314; Conn, C. Add. 1914.1; Fabre-Domergue, P. Add. 1914.1.

Ctenops. Arnold, J. P. 1904.1, 5, Add. 1914.5; Bartels, F. 1910.1; Finck, M. C. 1910.2; Kummer, H. 1904.1; Schäfer, P. 1915.1; Schiebold, A. 1912.1.

Macropodus (a domesticated variety of *Polyacanthus*). Bedriago, J. 1874.1; Butscher, A. 1900.1; Finck, M. C. 1911.3; Geyer, H. 1910.1; Heynhold, P. 1912.3; Langer, — 1877.1; Sasse, A. 1878.2; Sauer, —. 1913.1; Schäfer, P. 1915.2, 3; Schlömp, V. 1900.1; Schreiber, E. 1878.1; ★Stansch, K. 1907.1; Strixner, G. 1914.1; Wackenheim, M. 1912.1; Wrede, T. 1909.1; Zimmermann, —. 1911.2; Arnold, J. P. Add. 1914.6; Geyer, H. Add. 1914.1.

Osphromenus. Bade, E. 1897.1, 1912.2; Carbonnier, P. 1874.2; Engmann, P. 1901.2; Hohmann, K. 1912.2; Köhler, W. 1905.3; Lachmann, H. 1901.1; Langer, — 1877.1; Lehnert, K. 1910.1; Liebig, T. 1909.2; Marré, E. 1910.6; Melnikov, V. S. 1902.2, 1903.1; Reichert, J. 1906.1; Stansch, K. 1909.4; Geides, H. Add. 1914.2; Reichelt, J. Add. 1906.1.

Parosphromenus. Jürss, H. 1912.1.

Polyacanthus. Brüning, C. 1904.1; Duerigen, B. 1882.1, 1897.2; Engmann, P. 1909.4; Hélot, P. 1876.1; Pittrich, B. 1904.1; Pobowski, E. 1880.1; Reitz, A. 1910.2; Sasse, A. 1878.2; Schreitmüller, W. 1910.12; Stansch, K. 1911.10; Vogt, C. C. 1875.2; Weis, A. 1878.1.

Trichogaster. Arnold, J. P. 1904.4, 1911.24, 1912.29; Ehnle, H. 1910.11; Eter, P. 1913.1; Finck, M. C. 1910.5; Hohmann, K. 1911.3; Milewski, A. 1913.8; Noetzel, T. 1898.1; Reuter, F. 1912.2; Schäfer, P. 1915.1; Schreitmüller, W. 1912.10; Schulze, L. 1913.3; Stansch, K. 1909.2, 4; Steinhausen, A. 1904.1; Brüning, C. Add. 1914.17.

Percidæ

Acerina. Geyer, H. 1902.1; Sprenger, W. 1900.3.

Alvordius (*Hadropterus*). Schmitz, W. 1901.2; Sprenger, W. 1900.1.

Etheostoma. Rachow, A. 1911.14.

Perca. Reitmayer, C. A. 1912.1; Rost, G. 1914.1; Sprenger, W. 1900.3.

Serranidæ

Ambassis. Gerlach, G. 1909.1; Stansch, K. 1913.2; Träber-Klotsche, G. 1910.1; Anon. 34; Engmann, P. Add. 1911.2.

Apogon. Osburn, R. C. 1910.5.

Epinephelus. Osburn, R. C. 1912.2.

Therapon. Steiner, M. 1910.1.

Various genera belonging to other families of Acanthopterygii

Agonus. Müllegger, S. 1913.2. — *Aphredoderus*. Hesdörffer, M. 1902.2; Sprenger, W. 1901.5. — *Callionymus*. Müllegger, S. 1913.2; Newman, E. 1873.2. — *Capros*. Crane, A. 1879.1. — *Chrysophrys*, *Pagellus*, and *Sargus*. Beaux, O. 1910.1. — *Coris*. Birchall, E. H. 1876.1. — *Lepadogaster*. Hughes, W. R. 1864.1. — *Mullus*. Helder, W. 1899.2. — *Paraglyphidodon*. Arnold, J. P. 1912.17. — *Pleuronectes*. Koch, M. 1912.1; Schmidt, E. 1912.1; Zolotniskii, N. F. 1906.1. — *Psettus*. Brüning, C. 1913.3; Milewski, A. 1914.5, 1916.3. — *Scomber*. Francis, F. 1872.1; Hallock, C. 1873.2; Smith, John Alexander, 1867.4. — *Selene*. Arnold, J. P. Add. 1914.1. — *Toxotes*. Zolotniskii, N. F. 1902.1, 2.

Anacanthini

Lota (family *Gadidæ*). Kammerer, P. 1906.2; Milewski, A. 1914.1; Haffner, C. Add. 1914.1.

Apodes

Anguilla. Barfod, H. 1902.2; Bretagne, C. 1876.1; Haffner, C. 1911.1; Krause, Richard, 1911.1; Wiehle, E. 1910.1.

Catosteomi

Amphisile (family *Amphisilidæ*). Sokolovsky, A. 1916.1.

Gasterosteus (family *Gasterosteidæ*). Bolau, C. C. 1905.1; Buck, E. 1875.1; Haas, H. J. 1908.2; Johannsen, W. 1912.1; Pander, H. 1912.1; Reitmayer, C. A. 1913.2; Rohrbacher, L. 1915.1; Schneider, F. 1909.2; Werner, Fritz. 1915.1; Wrede, T. 1909.2, 3; Becker, K. Add. 1907.1.

Syngnathidæ

Doryichthys. Brüning, C. 1911.2; Rachow, A. 1913.9.

Hippocampus. Dambeck, K. 1877.3; Townsend, C. H. Add. 1913.3.

Siphonostoma. Bade, E. 1899.9.

Syngnathus. Dambeck, K. 1877.3; Gienke, H. 1913.1.

Haplomi

Esox. Haffner, C. 1912.2; Rost, G. 1914.2; Schreitmüller, W. 1915.9, 12; Walter, H. 1912.1.

Umbra. Bade, E. 1897.2; Lorang, Ch. 1913.2; Reitmayer, C. A. 1911.4; Schreitmüller, W. 1913.7.

Labyrinthici

Labyrinthici. Bruhn, J. 1911.1; Finck, M. C. 1910.4; Mandée, R. 1907.1; ★Stansch, K. 1909.3.

Microcyprini

Amblyopsis (*Mammoth cave blind-fish*). Schreitmüller, W. 1915.2.

Pæciliidæ (Cyprinodontidæ)

Pæciliidæ in general. Brüning, C. 1910.2; Finck, M. C. 1910.3, Add. 1914.1; Frank, P. 1913.1; Gerlach, G. 1903.1;

Aquarium Fishes — Cont'd.

Hohmann, K. 1912.6; Leonhardt, E. E. 1905.4; Marré, E. 1912.1; Peter, J. 1901.1; Ringel, E. 1911.1; Rost, G. 1914.4; Wichand, B. 1906.1; ★Arnold, J. P. Add. 1914.16, 19.

For the outstanding general works on the Cyprinodonts as aquarium fishes, see ★Stansch, K. 1909.1, 1911.6, 1912.1.

Alfaro amazonum and *A. cultratum* (*Petalosoma* and *Petalurichthys* are synonyms). Crandall, L. S. 1914.1; Rachow, A. 1911.18, 1913.15.

Anableps (the four-eyed fish). Brüning, C. 1910.2.

Belonesox belizianus. Arnold, J. P. 1910.1; Krüger, B. 1910.2; Reuter, F. 1912.1; Schick, C. 1912.1; Träber-Klotsche, G. 1911.1.

Characodon. Brüning, C. 1910.2.

Cnesterodon decemmaculatus. Butscher, A. 1901.2; Hencke, H. 1902.1; Kettler, — 1901.1; Matte, P. 1900.1, Add. 1900.1.

Cynolebias belloti. Arnold, J. P. 1911.19; Rachow, A. 1912.5; Rodewald, C. 1913.2; Träber-Klotsche, G. 1914.1.

Cyprinodon, chiefly *C. dispar*, *C. fasciatus* and *C. variegatus*. Arnold, J. P. 1912.6, Add. 1914.3; Baum, H. 1913.1; Findeis, G. 1909.1; Friedrich, M. J. 1911.1; Gerlach, G. 1911.2, 1912.6; Rachow, A. 1913.7; Schneider, F. 1909.1; Schulze, L. 1910.2, 1911.2; Unterberg, J. 1915.1; Vosseler, J. 1915.1; Wolterstorff, W. G. 1912.1; Stansch, K. Add. 1906.1.

Fitzroyia lineata (*Jenynsia*). Leonhardt, E. E. 1904.12; Rachow, A. 1913.15; Schreitmüller, W. 1910.6; Krüger, B. Add. 1914.2.

Fundulus, chiefly *C. dispar*, *gularis*, *majalis*, *pallidus*, and *C. sjöstedti*. Arnold, J. P. 1908.4, 1911.5, 13, 29, 1912.31, 1913.12, 13, Add. 1914.4; Bade, E. 1897.2; Ehnle, H. 1910.1; Fischer, H. 1910.1; Gellner, F. 1911.1; Gerlach, G. 1911.3; Kramp, E. 1913.2, Add. 1914.1; Krüger, B. 1913.6; Leonhardt, E. E. 1905.10; Mayer, F. & Rachow, A. 1911.1; Memmler, M. 1910.1; Milewski, A. 1913.3; Pugh, E. 1914.1; Rachow, A. 1911.4; Rauschenbach, W. 1912.1; Shufeldt, R. W. 1917.1; Stansch, K. 1911.12; Thumm, J. 1910.1; Träber-Klotsche, G. 1910.2, 3, 1911.2, 3, 1912.1; Woge, A. 1912.1; Wolterstorff, W. G. 1912.1.

Gambusia, chiefly *G. affinis*, *G. episcopi*, and *G. holbrooki*. Finck, M. C. 1912.1; Gerlach, G. 1912.2; Heede, C. J. 1912.1; Rachow, A. 1911.5; Sachs, J. 1913.1; Stansch, K. 1910.2; Stollreither, A. 1914.1; Tscheuke, W. 1904.1.

Girardinus. Stüve, H. 1901.1; Thumm, J. 1908.2.

Glaridichthys latidens. Leonhardt, E. E. 1907.4; Rachow, A. 1912.15; Schreitmüller, W. 1911.3.

Haplochilus of many species, chiefly *H. cameronensis*, *chaperi*, *elegans*, *fasciolatus*, *latipes*, *melastigma*, *panchax*, and *H. rubrostigma*. Arnold, J. P. 1906.4, 1907.3,

1908.1, 1911.6, 12, 30, 1912.12, Add. 1914.8; Aubry, O. 1912.1; Bade, E. 1898.5; Ehnle, H. 1910.2, 4; Eifert, E. 1910.1; Engmann, P. 1902.1; Finck, M. C. 1909.1, 1911.1, Add. 1914.1; Gerlach, G. 1911.4, 5, 1912.3, 4; Graichen, H. 1909.2, 3; Grohmann, J. 1909.1; Gruber, A. 1911.1; Homann, K. 1911.1; Kramp, E. 1913.1, Add. 1914.2; Liebers, A. 1913.1; Liebig, T. 1912.6; Liebscher, A. 1901.1; Lütge, A. 1905.1; Marré, E. 1909.2; Matte, P. 1901.2; Milewski, A. 1913.4, 5, 1915.4; Nicolai, E. 1910.1; Nieselt, E. 1910.1; Osswald, H. 1913.2; Rachow, A. 1912.10; Ringel, E. 1912.1; Rodewald, C. 1914.1; Sauer, — 1914.2; Schmitz, W. 1901.1; Schreitmüller, W. 1910.7, 1912.6; Schröder, W. 1906.3; Stansch, K. 1908.1, 2, 1910.3; Träber-Klotsche, G. 1911.5, 1912.2, 3, 5; Thumm, J. 1904.1, 1909.1; Wolterstorff, W. G. 1911.1, 1913.2; Zimmermann, — 1908.1; Zindler, A. 1914.1.

Heterandria formosa. Rachow, A. 1912.6, 16, 1913.10; Rost, G. 1914.5.

Jordanella floridae. Mayer, Albert 1914.1; Rachow, A. 1914.8; Kierich, F. Add. 1914.1.

Lebias, chiefly *L. sophiae* and *L. iberus*. Arnold, J. P. 1912.6, 15; Baum, H. 1913.1; Bierhance, E. 1912.1; Gerlach, G. 1911.2; Gienke, H. 1913.2; Rachow, A. 1913.7; Wolterstorff, W. G. 1912.1.

Lebistes reticulatus (formerly called *Girardinus guppyi* and *G. pæcilioides*). Arnold, J. P. 1909.1, 1912.10; Barfod, H. 1902.1; Both, E. 1910.1; Ehnle, H. 1910.7; Finck, M. C. 1910.1; Graichen, H. 1909.1; Hannik, P. 1911.1; Hippus, K. 1909.1; Köhler, W. 1906.1, 1910.1; Krüger, B. & Wolterstorff, W. 1910.1; Kuhnt, B. 1910.1; Liebscher, A. 1901.4; Mandée, R. 1907.2; Rachow, A. 1911.17; Schroot, W. 1901.2, 3; Schulze, L. 1911.1.

Limia. Eter, P. Add. 1914.1.

Lucania. Nichols, J. T. 1916.3.

Mollienisia, including *M. latipinna*, *M. petensis*, *M. sphenops*, and *M. velifera*. Ehnle, H. 1910.3; Friedrich, M. J. 1909.1; Hohmann, K. 1911.2; Lutz, J. 1914.1; Marré, E. 1913.1; Mayer, F. 1914.1; Mazatis, F. 1914.1; Rolle, W. 1910.1; Schreitmüller, W. 1913.5; Schroot, W. 1903.1; Brüning, C. Add. 1914.11, 12.

Phalloceros caudimaculatus. Liebig, T. 1909.3.

Phalloptychus januaris. Hey, F. 1909.1; Heynhold, P. 1912.2; Langner, A. 1910.1; Lorang, Ch. 1912.2; Riedel, K. 1910.1; Strieker, M. 1909.1; Träber-Klotsche, G. 1909.1, 1911.4; Wolterstorff, W. G. 1909.2, 1910.2, 3, 1911.2.

Platypæcilus maculatus. Gerlach, G. 1912.8; Hohmann, K. 1912.2; Hopdi-quaks, — 1913.1; Leonhardt, E. E. 1908.2; Osswald, H. 1913.3; Schreitmüller, W. 1910.11, 16, 1911.7; Stansch, K. 1911.8; Wildner, E. 1912.3.

Pæcilia of various indeterminate species. Arnold, J. P. 1909.5, 1911.22, 1912.21,

- .27, 1913.17; Bormann, A. F. 1910.1; Brüning, C. 1903.3; Finck, M. C. 1911.5; Gerlach, G. 1910.2; Lachmann, H. 1901.2; Leonhardt, E. E. 1905.19, 1906.11; Liebig, T. 1913.2; Marré, E. 1910.11; Matte, P. 1902.1; Rachow, A. 1910.4; Reichelt, J. 1910.2, 3; Stansch, K. 1907.2, 1911.9, 1913.5, 1914.1; Stricker, M. 1906.1, 1909.2; Thumm, J. 1907.3, 1909.4, 1910.2.
- Pseudoxiphophorus bimaculatus*. Ehnle, H. 1910.9; Funk, E. 1910.1; Gerlach, G. 1910.1; Zimmermann, — 1909.1.
- Rivulus* including *R. flabellicauda*, *R. harti*, *R. ocellatus*, *R. poeyi*, and *R. tenuis*. Arnold, J. P. 1912.25, 1913.20; Biehn, H. 1911.1; Börgershausen, W. 1910.1; Ehnle, H. 1910.10; Finck, M. C. 1911.7; Friedrich, M. J. 1910.1; Gerlach, G. 1909.2; Geyer, H. 1912.1; Hohmann, K. 1911.1, 1912.5; Langer, O. 1910.1; Mädcl, S. 1910.1; Potempa, A. 1910.1; Reiss, E. 1912.1; Rost, G. 1913.5; Rozynski, P. 1909.1; Schäfer, K. 1914.1; Schreitmüller, W. 1912.4; Zindler, A. 1912.1.
- Tomeurus*. Rachow, A. 1911.16, 18, 1913.15.
- Xiphophorus* (Mexican Sword-tail), chiefly *X. guentheri*, *X. helleri*, and *X. rachovii*. Arnold, J. P. 1909.10; Ehnle, H. 1910.5; Gerlach, G. 1912.5, 7, 1913.1; Hartwig, W. 1912.1; Marré, E. 1910.13; Milewski, A. 1912.5; Osswald, H. 1912.2; Rachow, A. 1910.8, 1911.8, 1913.16; Regan, C. T. 1911.17, 1913.23, 1914.7; Reitmayer, C. A. 1915.5; Rost, G. 1913.4; Schiche, E. 1915.1; Wegner, J. E. 1913.1; Weinhausen, H. 1911.1; Wolterstorff, W. G. 1913.3, Add. 1914.1; Zimmermann, — 1909.2; Brüning, C. Add. 1914.3.
- Zygonectes*. Leonhardt, E. E. 1906.15.
- Ostariophysi**
- Bunocephalus* (family *Aspredinidae*). Schröder, W. 1906.2.
- Characinidae**
- For the best general article on Characinidae in aquaria, see Stansch, K. 1911.3.
- General papers*. Brüning, C. 1910.1, 1912.2; Mayer, F. & Rachow, A. 1910.1; Rachow, A. 1913.12; Reuter, F. 1916.1.
- Acestrorhynchus*. Rachow, A. 1914.1.
- Alestes*. Arnold, J. P. 1912.1.
- Anostomus*. Arnold, J. P. 1913.1; Schreitmüller, W. 1914.1.
- Carnegiella*. Krüger, B. 1913.2.
- Characidium*. Gellner, F. 1913.1; Rachow, A. 1913.2, 1914.9; Hecker, W. Add. 1914.1.
- Chilodus*. Rachow, A. 1913.3.
- Chirodon*. Harke, W. 1913.1; Heynhold, P. 1911.1; Rachow, A. 1911.9.
- Copeina*. Arnold, J. P. 1913.7.
- Cretochanes*. Rachow, A. 1914.1.
- Erythrinus*. Arnold, J. P. 1911.11.
- Gasteropelecus* (the fresh-water flying fish of South America). Krüger, B. 1913.2; Marré, E. 1910.4; Mayer, F. 1910.2; Milewski, A. 1916.1; Rachow, A. 1910.2.
- Hemigrammus*. Ellis, M. L. 1911.1; Liebig, T. 1912.4; Schreitmüller, W. 1912.11; Stansch, K. 1911.5.
- Hydrocynus*. Rachow, A. 1913.11.
- Iguanodectes*. Rachow, A. 1912.7.
- Jobertina*. Rachow, A. 1913.2.
- Leporinus*. Gellner, F. 1913.1; Krüger, B. 1913.3; Milewski, A. 1914.4, 1915.6; Rachow, A. 1910.9.
- Lebiasina*. Brüning, C. Add. 1914.9.
- Macrodon*. Arnold, J. P. 1911.18.
- Metynnis*. Wolterstorff, W. G. 1908.3; Stricker, M. Add. 1908.1.
- Micralestes*. Andres, Ad. 1913.1, 2.
- Mimagoniates*. Rachow, A. 1912.9.
- Myletes*. Liebig, T. 1913.3; Rachow, A. 1911.6; Schreitmüller, W. 1915.11.
- Nannostomus*. Rachow, A. 1910.3; Witting, E. 1911.1.
- Neolebias*. Rachow, A. 1911.7.
- Paragoniates*. Arnold, J. P. 1911.20; Rachow, A. 1911.10.
- Petersius*. Arnold, J. P. 1909.4, 1911.21; Jürss, H. 1913.1.
- Phago*. Arnold, J. P. 1912.20.
- Poecilobrycon*. Milewski, A. 1915.8; Rachow, A. 1911.11, 1913.13.
- Pseudochalceus*. Rachow, A. 1912.12.
- Pseudocorynopoma*. Ehnle, H. 1910.8; Leonhardt, E. E. 1906.12; Schreitmüller, W. 1915.5; Schulze, L. 1911.3.
- Prochilodus*. Arnold, J. P. 1912.23; Rachow, A. 1910.5; Reuter, F. 1914.3.
- Pyrrhulina*. Arnold, J. P. 1909.8; Kittler, O. 1907.1, 1909.1; Marré, E. 1910.8, 1911.2; Metzges, P. 1908.1; Rachow, A. 1911.12; Schäme, P. 1908.1; Schreitmüller, W. 1912.9; Stansch, K. 1912.4; Thumm, J. 1907.4; Windtrath, P. 1916.1; Wolterstorff, W. G. & Schäme, P. 1907.1; Stricker, M. Add. 1908.2.
- Serrasalmo*. Rachow, A. 1913.14.
- Tetragonopterus*. Blaue, O. 1911.1; Hohmann, K. 1912.4; Krüger, B. 1910.3, 1913.7; Leonhardt, E. E. 1907.7; Liebig, T. 1912.7; Marré, E. 1910.10; Mayer, F. 1911.1; Milewski, A. 1913.7; Potempa, A. 1911.2; Rachow, A. 1910.7; Schreitmüller, W. 1911.8, 1912.12, 1914.6; Stricker, M. 1909.3; Wendt, A. 1916.1.
- Xiphorampus*. Arnold, J. P. Add. 1914.18.
- Cyprinidae**
- General accounts*. Jürss, H. 1911.2; Brüning, C. Add. 1914.2.
- Abramis*. Schreitmüller, W. 1910.1.
- Acanthocephalus*. Arnold, J. P. 1911.1; Schreitmüller, W. 1910.2.
- Alburnus*. Klose, C. 1910.1; Schreitmüller, W. 1914.12, 1915.1.
- Amblypharyngodon*. Arnold, J. P. Add. 1914.1.
- Aspius*. Schreitmüller, W. 1914.2, 12.
- Barbus*. Arnold, J. P. 1912.3; Bade, E. 1905.1; Brüning, C. 1905.4, 1912.4, Add. 1914.3, 14; Finck, M. C. 1912.2; Gerlach, G. 1911.1; Köhler, W. 1905.2; Krüger, B. 1913.1; Rachow, A. 1910.1, 1911.1, 1912.14; Reichelt, J. 1906.1; Reitz, A. 1911.1; Rost, G. 1913.1, Add.

Aquarium Fishes — Cont'd.

- 1914.1; Schreitmüller, W. 1909.1, 1911.1, 1912.16, 1914.9, 1916.1; Schröder, W. 1906.1; ★Stansch, K. 1906.1, 1911.1, 2, Add. 1906.1; Stieler, W. 1905.1; Thomas, —. 1904.1; Trog, E. 1913.1; Wendt, A. 1916.2; Westphal, F. 1905.1; Andres, Ad. Add. 1914.1; Hermann, F. Add. 1906.1.
- Barilius*. Andres, Ad. 1913.1, 2; Stuyvenberg, H. 1913.1.
- Capoeta*. Marré, E. 1910.2; Rost, G. 1913.2.
- Chelæthiops*. Andres, Ad. 1913.1, 2.
- Chondrostoma*. Schreitmüller, W. 1914.4.
- Chrosomus*. Rachow, A. 1912.1.
- Cobitis*. Haffner, C. 1911.3; Köhler, W. 1909.1; Lauppe, L. 1903.1; Meixner, —. 1915.1; Reitmayer, C. A. 1915.3; Schnee, S. 1905.2; Sprenger, W. 1900.6; Thumm, J. 1905.2; Veesenmeyer, —. 1863.1.
- Danio*. Arnold, J. P. 1911.8, 9, 1912.7; Baum, H. 1910.1, 1912.1; Dallmann, G. 1911.1; Hänig, K. 1912.1; Hartwig, W. 1908.1; Kozlov, D. 1905.1; Leonhardt, E. E. 1906.3; Liebig, T. 1906.1; Lorang, Ch. 1913.1; Milewski, A. 1913.2; Osswald, H. 1912.1; Rachow, A. 1911.2; Reitmayer, C. A. 1916.2; Reitz, A. 1911.3; Rost, G. 1913.3; Schreitmüller, W. 1911.10, 13, 1912.8, 13; Schulze, L. 1913.1; Stahl, H. 1910.1; Wildner, E. 1912.1, 2; Herold, B. Add. 1914.1.
- Gobio*. Kleine, M. 1912.1; Reitmayer, C. A. 1911.2, 1915.4.
- Lepidocephalichthys*. Köhler, W. 1905.2.
- Leucaspis*. Engelmann, H. 1910.1; Kammerer, P. 1909.2; Schreitmüller, W. 1910.17; Wolterstorff, W. G. 1910.1.
- Leuciscus*. Gramsch, E. 1909.1; Kammerer, P. 1909.2, 3; Rachow, A. 1912.8; Reitmayer, C. A. 1913.1; Schermer, E. 1915.3.
- Misgurnus*. Rost, G. 1914.3; Schreitmüller, W. 1913.8; Köhler, W. Add. 1906.1.
- Notropis*. Rachow, A. 1914.5; Shufeldt, R. W. 1917.1.
- Nuria*. Bock, R. 1914.1; Osswald, H. 1914.1; Pfeiffer, K. 1910.2; Schreitmüller, W. 1911.11, 1914.8; Stoll, A. A. 1906.1; Anon. 423.
- Phoxinus*. Bade, E. 1899.2; Reitmayer, C. A. 1911.1.
- Rasbora*. Arnold, J. P. 1911.25, 1912.24, 1913.18; Bormann, A. F. 1910.2; Brüning, C. 1911.5; Liebig, T. 1911.1; Marré, E. 1910.9; Rachow, A. 1911.13; Reichelt, J. 1906.7, 1910.4; Schulze, L. 1912.3; Schreitmüller, W. 1910.13; Stansch, K. 1910.5; Träber-Klotsche, G. 1911.7; Hammer, J. Add. 1914.1.
- Rasborychthys*. Arnold, J. P. 1913.19.
- Rhinichthys*. Brüning, C. 1904.2.
- Rhodeus*. Braun, P. 1901.1; Reitmayer, C. A. 1912.2.
- Ræboides (Epicyrthus)*. Rachow, A. 1910.6; Schreitmüller, W. 1913.4.
- Tinca*. Bade, E. 1898.6; Kammerer, P. 1909.2.

Squalius. Schreitmüller, W. 1910.5.

It being impossible to separate the care and culture of the gold fish, Carassius auratus, in aquaria from its pond culture, the whole subject will be found under the family Cyprinidae in the systematic section.

Gymnotidae

Carapus. Schreitmüller, W. 1915.6.

Gymnotus. Arnold, J. P. 1913.24; Chiaje, S. delle 1847.1; Geoffroy-Saint-Hilaire, E. F. 1822.2; Palmstedt, C. 1842.1.

Rhamphichthys. Brüning, C. 1911.6.

Loricariidae

General accounts. Brüning, C. 1910.5; Kaiser, E. 1910.2; Franck, P. Add. 1914.1.

Otocinclus. Arnold, J. P. Add. 1914.11.

Plecostomus. Milewski, A. 1915.7; Rachow, A. 1914.6; Stansch, K. 1912.3.

Xenocara. Arnold, J. P. 1912.32.

Siluridae

Amiurus. Liebig, T. 1913.4; Lorang, Ch. 1912.1; Schreitmüller, W. 1910.3.

Callichthys. Brüning, C. 1910.5; Freund, L. 1912.1; Helder, W. 1899.1; Liebscher, A. 1904.1; Leonhardt, E. E. 1906.6; Reitz, A. 1910.1; Scheljuzhko, L. 1911.1; Schreitmüller, W. 1910.3.

Chrysichthys. Arnold, J. P. 1913.2.

Corydoras. Arnold, J. P. 1912.5, 1913.8; Freund, L. 1912.1; Haffner, C. 1911.2; Liebig, T. 1912.5; Rachow, A. 1913.5.

Clarias. Arnold, J. P. 1912.4; Boulenger, G. A. 1899.7; Kaiser, E. 1910.1; Schreitmüller, W. 1915.7; Schroot, W. 1901.1.

Eutropius. Rachow, A. 1911.3.

Gymnallabes. Arnold, J. P. 1912.11.

Macrones. Leonhardt, E. E. 1906.10; Schreitmüller, W. 1910.3; Brüning, C. Add. 1904.1.

Malopterurus. A., C. 1858.2; Brüning, C. 1908.1; Du Bois-Reymond, E. H. 1857.1, 2, 1858.1, 2; Schreitmüller, W. 1911.4; Solotnitzky, N. F. Add. 1900.1.

Pimelodus. Kaiser, E. 1910.3.

Pinoleus. H., W. 1899.1.

Rhamdia. Brüning, C. Add. 1914.16.

Saccobranchius. Fränkel, F. 1912.1.

Silurus glanis. Kammerer, P. 1907.3; Milewski, A. 1916.2; Meiselbach, M. 1913.1; Seliuzko, — 1908.1; Solotnitzky, N. F. 1902.2.

Trachycorystes. Schreitmüller, W. 1915.7.

Malacopterygii

Coregonus. Heuscher, J. 1898.1; Brüning, C. Add. 1914.13.

Marcusenius. Arnold, J. P. 1909.3; Schreitmüller, W. 1912.3.

Osteoglossum. Rachow, A. 1912.11.

Pantodon (the fresh-water flying fish of Africa). Arnold, J. P. 1906.2, 1907.2, 1911.4, 26, 27; Brüning, C. 1911.7; Lehmann, A. 1912.1; Marré, E. 1910.7; Peters, W. C. 1877.5; Schreitmüller, W. 1912.2; Schulz, J. 1911.1; Siegl, H. 1912.1, 1914.1, 2.

Phractolæmus. Brüning, C. 1912.3; Jürgens, W. 1910.1; Köhler, W. Add. 1906.2.

Tarpon atlanticus. Townsend, C. H. 1906.2.

Thymallus. Schreitmüller, W. 1913.6.

Xenomystus. Arnold, J. P. 1909.9; Schreitmüller, W. 1912.17; Wittig, F. 1913.2.

Percesoces

Agonostomus. Rachow, A. 1913.1.

Anabas. Arnold, J. P. 1912.2, 14, 1913.23; Brüning, C. 1905.2, 1911.1; Carbonnier, P. 1874.2; Knöpfler, F. 1909.1; Liebscher, A. 1901.2; Schröder, O. 1910.1; Vetterlein, R. 1914.1; Wendt, A. 1915.1; Meissen, K. Add. 1895.1.

Atherinichthys. Rachow, A. 1914.2.

Hemirhamphus. Nobis, J. 1913.1; Reichelt, J. 1906.6; Schreitmüller, W. 1910.8, 9, 1911.6; Stansch, K. 1910.4.

Mugil. Marré, E. 1910.3.

Plectognathi

Tetrodon. Arnold, J. P. 1904.3; Cohn, Fritz 1912.1; Kaiser, E. 1911.1; Leonhardt, E. E. 1904.19; Reichelt, J. 1906.8; Stansch, K. 1913.3; Thumm, J. 1907.5; Wolterstorff, W. G. 1908.2, 1909.1; Zolotniskii, N. F. 1908.1; Anon. 402; Schäme, P. Add. 1907.1.

Teleostean fishes of various sub-orders

Antennarius. Sokolovsky, A. 1915.1.

Mastacembelus. Jürgens, W. 1904.1; Leonhardt, E. E. 1905.18.

Symbranchus. Masi, L. 1910.1; Simon, E. 1914.1.

ARCHÆOLOGY

Exhibiting the part played by fishes in the life of prehistoric man.

An authoritative popular treatise on archæology, which may be used in connection with the following reference, is Henry Fairfield Osborn's, "Men of the Old Stone Age." New York, 1915.

For a readable general treatise on most of the topics comprised in this section, consult ★Rau, C. 1885.1.

Old Stone Age or Upper Palæolithic culture stations of Europe. *Evidences of interest in, or use of, fishes by early man.*

"Reindeer period" as exhibited by caves of south-western France. — Pike engraved on bear's tooth from Sorde (Duruthy) grotto, Landes Dep't. Lartet, L. & Duparc, L. 1874.1. — Reindeer and salmon engraved on antler from Lorthet, Hautes-Pyrénées. Piette, E. 1904.1. — Fish-bones, vertebrae, etc., in caves of Vézère valley of Dordogne. ★Sauvage, H. E. 1870.1.

Fish remains found in rock-shelters, caverns and grottos, or culture stations of — Schweizersbild near Schaffhausen, Switzerland. Fatio, V. 1902.2; Keller, R. 1896.1. — Furinha-grotto, Portugal. Harlè, E. 1909.1. — Ludmirov cavern, Hungary. Knies, J. 1905.1. — Arene Candide cavern, Italy. Morelli, N. 1891.1. — Grottos of Menton, Italy. Rivière, E. 1880.1–1887.1.

— Romanelli grotto, Otranto, Italy. Stasi, P. & Regalia, E. 1904.1. — Swanscombe, Kent, England. Stopes, C. 1903.1.

Animal remains, including a few fishes, in caves of Ireland. Scharff, R. F. 1903.1; Scharff, Ussher, and others 1906.1.

Fish remains found in kitchen middens or artificial shell heaps (probably neolithic) of — Jæderen district, Norway. Brögger, A. W. 1908.1. — Hardanger uplands, Norway. Grieg, J. A. 1911.1. — Denmark. Petersen, C., Winge, H. & Winge, O. 1888.1; Winge, A. H. 1903.1.

Prehistoric fishing implements. *Development or history of the fish-hook, harpoon, etc., based on bone, horn, and bronze specimens from the various European culture stations, especially those of the Swiss lake-dwellers and including the designs of the American Indian.* Abbott, C. C. 1872.3; Köhler, K. E.; Klunzinger, C. B. 1892.1, 3; Leonhardt, E. E. 1903.5; ★Philips, B. 1880.1, 1883.3, Add. 1883.1; ★Rau, C. 1885.1; Anon. 221, 674; Christensen, R. Add. 1881.1; Hein, W. Add. 1912.1; Krause, E. Add. 1897.1, 1904.1; Lampert, — Add. 1914.1; Lubbock, J. Add. 1872.1; Schmitter, A. Add. 1911.1; Schultze, M. Add. 1914.1.

Prehistoric fishing in Japan. Kishinouye, K. 1911.2.

American archæology

The fish in ancient Peruvian art. Mead, C. W. 1909.1, 1916.1. — *Fish figures in pottery in Argentina.* Torres, L. M. 1907.1.

Aboriginal American harpoons. Mason, O. T. Add. 1902.1. — *Bone fish-hooks of Little Miami valley.* Putnam, F. W. Add. 1887.1, 1888.2.

Classical archæology

Fish portrayals in the Roman catacombs. Achelis, H. 1888.1. — *Greek vase-paintings showing fishes.* Morin-Jean 1911.1; Emerson, A. Add. 1914.1.

Drying fish by Egyptians, portrayed on tombs of Pharaohs. Boussac, P. H. 1909.1, 1910.1, 2.

Mummified fishes of ancient Egypt. Gal, F. G. 1902.1; Lortet, L. & Gaillard, C. 1903.1–1909.1; Lortet & Hugounenq 1901.1; Pellegrin, J. 1900.7.

For a valuable recent work in English, on Greek and Roman, Egyptian, Assyrian, and Jewish fishing; including the economic and religious uses of fishes by these peoples, see ★Wm. Radcliffe. "Fishing from the earliest times." London. 1921. 478 p. ills.

For a similar work in German, "Die Antike Tierwelt," see ★Keller, O. 1909.1.

AUDITORY ORGANS

Consisting in fishes of the membranous labyrinth and its parts.

For the functions of the membranous labyrinth, see Hearing and the Static Sense.

General treatises on the auditory organs. ★Ayers, H. 1892.1; ★Retzius, M. C. 1881.2; ★Weber, E. H. Add. 1820.1.

Auditory Organs — Cont'd.

Important papers on the structure of the ear. ★Breschet, G. 1832.1, 1838.1; Canestrini, R. 1886.2; Dufossé, A. 1874.1; Fischer, C. E. 1862.1; Hasse, J. C. 1869.1, 1873.2; Vescovi, P. 1891.1.

Miscellaneous papers. Beard, J. 1884.1; Camper, P. 1763.1, 1774.1, Add. 1763.1, 1792.1; Comparetti, A. 1789.1; Cuvier, G. & Duméril, A. 1830.1; Duméril, A. M. 1832.1, 1835.1, 1858.1; Gegenbaur, C. 1886.1; Hunter, J. 1782.1; Koelreuter, J. G. 1772.1; Retzius, M. G. 1875.1; Scarpa, A. 1789.1; Webb, W. M. 1905.1; Geoffroy, E. F. Add. 1778.1, Pre-Linn. 1755.1; Vicq-d'Azyr, F. Add. 1781.1; Villeneuve, — Add. 1760.1, Pre-Linn. 1756.1; Casserius, J. Pre-Linn. 1601.1; Nollet, J. A. Pre-Linn. 1746.1.

Anatomy and histology

Anatomy of parts of labyrinth. — *Cupula terminalis.* Hasse, J. C. 1870.1 (*Cyprinidae*); Hensen, V. A. 1878.1; Studnička, F. K. 1912.1 (*Petromyzon*). — *Sacculus.* Shepherd, C. E. 1914.1. — *Dimensions of semicircular canals.* Wulf, B. 1901.1. — *Nature of endolymph.* Doesschate, G. Add. 1914.1. — *Structure of "Cochlea" (Lagena), Esox.* Hein, J. P. Pre-Linn. 1671.1.

Anatomy of membranous labyrinth in various groups, including histological structure. (Of *Cyclostomes*, *Myxine* has one semicircular canal, and *Petromyzon* two; all higher fishes three.)

Cyclostomata. Ecker, A. 1844.1, 1854.2; Ketel, H. 1873.1; Krause, Rud. 1905.1, 1906.2; Müller, J. (*Myxine*) 1834.1; Ovsyannikov, F. V. 1864.1, 1865.1; Studnička, F. K. 1912.1.

Elasmobranchii. Buchanan, T. 1828.1; Everett, W. H. 1896.1; Retzius, M. G. 1878.1, 2, 1880.3; Stewart, C. 1906.1, 2.

Ganoidei and Dipnoi. — *Neoceratodus.* Burne, R. H. 1913.1. — *Ganooids.* Cisow, A. 1880.1. — *Calamoichthys and Polyp-terus.* Retzius, M. G. 1881.3.

Teleostei. Kuhn, A. 1877.1; Retzius, M. G. 1871.1, 3, 1875.1, 1880.3. — *Amblyopsidae.* Eigenmann, C. H. & Yoder, A. C. 1899.1; Wyman, J. 1854.5. — *Mormyrus.* Fischer, L. H. 1854.1; Heusinger, C. F. 1826.1; Marcusen, J. 1864.1. — *Gastroblecus and Pimelodus.* Heusinger, C. F. 1826.1. — *Cyprinidae.* Lang, G. 1863.1, 1864.1. — *Orthogoriscus.* Meek, A. 1904.4; Thompson, D. W. 1888.1. — *Lepidoleprus.* Otto, A. W. 1826.1. — *Rhadinichthys.* Parker, G. H. 1908.4. — *Exocætus.* Tschernoff, N. D. 1909.1. — *Hypophthalmus.* Wright, R. R. 1885.4, 1886.1. — *Deep-sea fishes.* Bierbaum, G. Add. 1914.1.

Peripheral nerve terminations in the organs of hearing.

Peripheral termination of the eighth or auditory nerve in the epithelium (cristæ and maculæ acusticæ) of the ampullæ, sacculus, and lagena of the labyrinth. Hartmann, R. 1862.1; Lang, G. 1863.1, 1864.1; Morrill,

A. D. 1896.1; Krause, R. 1896.1, 1905.1; Retzius, M. G. 1871.3, 1881.4; Rüdinger, N. 1870.1; Schulze, F. E. 1862.1; Mullenix, R. C. Add. 1909.1. — *In Leucopsarion.* Kató, H. 1911.1. — *In Petromyzon.* Tretjakoff, D. 1908.2.

See also, Auditory nerve under Nervous System, peripheral.

Development of membranous labyrinth

For a general account of development in all groups, see ★Krause, R. 1906.1.

General researches. Mitrofanov, P. I. 1890.1; Poli, C. 1897.1; Sidoriak, S. 1899.1; Stummer-Traunfels, R. 1910.1; Wenig, J. 1913.1.

Development in various fishes. — *Am-mocætes.* Gaskell, W. H. 1898.1 (x); Norris, H. W. 1896.1. — *Torpedo.* Hellmann, — 1898.1. — *Teleostei.* Noorden, C. 1883.1; Wenig, J. 1911.1, 2.

Development of parts of the labyrinth. — *Ductus endolymphaticus.* Krause, R. 1901.1. — *Macula neglecta.* Okajima, K. 1911.1. — *Sacculus endolymphaticus.* ★Sterzi, G. 1909.1. — *Ampullæ in Am-mocætes.* Tretjakoff, D. 1908.1.

Connections with air bladder**Of the membranous labyrinth**

Apposition of paired tubular prolongations of air bladder to outer surfaces of fibrous membranes closing vacuities in bony walls of periotic capsules. — *Notopterus.* Bridge, T. W. 1900.1. — *Lotella.* Parker, T. J. 1882.3.

Protruding outgrowths of utriculus or sacculus forming otolith chambers in contact with anterior tubular extensions of air bladder. — *Clupeidae.* Beaufort, L. F. 1908.1; Ridewood, W. G. 1891.1; Tysowski, A. 1909.1. — *In certain Acanthop-terygii.* Starks, E. C. 1908.2.

Weberian apparatus in Ostariophysi consisting of modifications of parts of the first three vertebræ.

The following historical résumé is abstracted from Baudelot, E. 1868.5. These bones were first noticed in the carp by Rosenthal. They were further described by Weber who homologized them with the mammalian auditory ossicles, calling them malleus, incus, stapes and claustrum. Meckel and later Brechet were also inclined to this view. This view was strongly opposed, however, by Geoffroy St. Hilaire, who considered them to be the modified ribs of the first, second and third vertebræ. Saagmans Mulder originally considered them as a part of the auditory apparatus, but later came to the conclusion that they were ribs or parts of the vertebral apophyses. Baudelot believed that these bones represent the superior arches of the first and second vertebræ, the inferior arch of the third and the os intercrural parted in two.

Morphology, general treatise. ★Sagemehl, M. 1884.1. — *Discovery made known.* Weber, E. H. Add. 1820.1.

Morphology. General accounts. Baudelot, E. 1868.4, 5; Geoffroy-Saint-Hilaire, E. F. 1824.4, 6, 12, 13; Huschke, E. 1822.1; Pacini, F. 1846.1.

Anatomy in various families of fishes. — *Cyprinidæ*. Baudelot, E. 1873.1; Müller, A. 1853.1; Saagmanns Mulder, A. E. 1831.1; Nusbaum, J. 1881.1, 1882.1, 1908.1, 2; Sachs, M. M. 1912.1; Sidoriak, S. 1900.1; Yasui, K. 1905.1; Anon. 560. — *Cobitidæ*. Bloch, L. 1900.1; Nusbaum, J. 1899.1; Sidoriak, S. 1900.1. — *Siluridæ*. ★Bridge, T. W. & Haddon, A. C. 1889.1, 1893.1; Reis, K. 1905.1; Reissner, E. 1859.2; ★Sørensen, W. E. 1890.1, 1895.1; Wright, R. R. 1884.2, 1885.3, 4, 1886.1.

Functions of the Weberian apparatus. Bonnier, P. 1895.1; Sørensen, W. E. 1895.1. — *Considered a manometric apparatus or pressure gauge.* Thilo, O. 1906.1, 1907.1, 2, 1908.2.

BEHAVIOR

Comprising the comparative psychology of fishes

For all reactions to chemical stimuli, acidity, alkalinity dissolved gases, etc., see under Physiology.

For auditory reactions, see Hearing; for olfactory reactions, see Smell, etc.

For the associations of fishes and invertebrates, see Commensalism and symbiosis.

For the care of their eggs and young by fishes, see Parental care, under Reproduction.

A delightful readable volume on animal behavior including much on fishes and a bibliography, is ★ "The animal mind" by Margaret Floy Washburn. New York, 2nd ed., 1917, 386 p.

For an illuminating treatise on animal behavior, see ★Watson, J. B. Add. 1914.1; for a general review, ★Sanford, E. C. 1903.1; for a related topic, ★Baglioni, S. Add. 1910.1.

Accounts or narratives, depicting unusual actions or behavior.

Aquarium fishes, as affected by earthquake. Auer, C. 1909.1.

Weather prophets among fishes. Dankler, M. 1899.2; Gutmann, C. A. 1842.1. — *Pleuronectes*. Philippsen, H. 1913.1.

Misgurnus (Cobitis), the loach, so-called "weather-fish" or barometer-fish, supposed to foretell weather changes. Inwards, R. Add. 1898.1; Brückmann, F. E. Pre-Linn. 1741.1; Chapelle, — Pre-Linn. 1733.1; Clauder, G. Pre-Linn. 1687.1; Venzky, G. Pre-Linn. 1740.1.

Chub picking flies from cattle. Moodie, R. L. 1909.1. — *Fishes picking mites from skin of men who immerse purposely.* Anon. 235.

Trout leaps from flume into water below. Redding, B. B. 1879.3.

Reaction to their images in a mirror. Žezula, B. 1909.1.

Behavior of various types. Chiefly instinctive.

Activity and repose. Polimanti, O. 1911.2; Szymanski, J. S. 1914.1.

Instincts and reflexes. — *Miscellaneous.* Blanchard, C. E. 1866.1; Sutton, F. 1899.1; Kirby, W. Add. 1835.1. — *Larval Amia, and Anguilla.* Dean, B. 1896.3, 1912.2. — *Reflex of Gasterosteus.* Garrey,

W. E. 1905.1. — *Amphioxus, behavior.* Hussakof, L. 1910.4. — *Reactions of embryos.* Paton, S. 1908.1. — *Brook trout fry.* White, G. M. 1915.1.

Interrelation of sensory stimulation. ★Parker, G. H. 1907.1, 1908.3.

Manifestation of anger, fear and other emotions. Day, F. 1878.4; Elmhirst, R. 1912.1; Keene, J. H. 1880.2; Whitmee, S. J. 1878.1. — *Hæmulon about to attack displays vivid red lining of the mouth.* Reighard, J. E. 1915.1.

Sensibility to pain. Bentley, C. S. 1881.1; Cholmondeley-Pennell, H. 1870.1.

Color perception. (Color vision) Reactions or sensitivity to differences in wave-length. The following experiments show a choice of certain colored lights or backgrounds, without regard to associative processes.

For experiments wherein color discrimination as shown by fishes is associated with an agreeable or disagreeable sensation (chiefly food), see below under Memory or retention.

For the influence of color perception in producing adjustment to surroundings, see Changes in coloration under Coloration.

Belief in the existence of reactions to color or wave-length, rather than intensity. Bauer, V. 1909.1–1911.1; ★Frisch, K. 1911.4–1913.1, Add. 1913.1, 1914.1; Goldsmith, M. 1912.1, Add. 1914.1; Graber, V. Add. 1884.1; Haempel, O. & Kolmer, W. Add. 1914.1.

Color sense considered non-existent; fishes perceive colors as shades of gray, exactly like a person totally color-blind. ★Hess, C. 1910.1, 1912.1, Add. 1913.1, 1914.1. — *Remarks on this.* Franz, V. Add. 1914.1.

Color perception (non-existent) in *Amphioxus*. Krause, W. 1897.1.

Early exp. on keeping fishes in vessels of different colors. Stark, James. 1830.1.

For a popular résumé in German of all phases of color perception, see ★Kafka, G. Add. 1914.1.

Theories concerning the anatomical basis for color vision. Fritsch, G. T. 1904.1; Lubosch, W. 1909.2; Patten, W. 1898.1.

Suggestion that luminosity of deep-sea fishes (alleged to produce colored lights) may imply color perception. Trojan, E. 1914.1. — *Artificial flies used by anglers, supposed to indicate color-sense.* Abbott, C. C. Add. 1884.1.

Galvanotaxis. Reaction to electrical stimulus. Alluaud, C. & Vlès, F. 1911.1; ★Breuer, J. 1905.1, 2; Fujita, M. 1906.1; Ramstedt, C. O. 1872.1.

Immunity of *Fundulus* eggs to electrical stimulation. Brown, O. H. 1903.1.

Geotropism. Loeb, J. Add. 1891.2. — *Influence of gravity on development.* Rauber, A. 1885.1.

Intelligence. Various anecdotes, notes, and observations supposed by their writers to indicate "intelligence" in fishes. Abbott, C. C. 1883.1; Clarke, S. C. 1880.2; Dambeck, K. 1878.1; Day, F. 1881.2; Franz, V. 1906.2, 1912.4; Gurley, R. R. 1902.1;

Behavior — Cont'd.

La Blanchère, P. R. 1870.3, 1876.1; Leonhardt, E. E. 1909.1; Lépinay, S. 1907.1; Moulton, L. M. 1880.1; Ohm, P. 1909.1; Rivera, E. 1905.1; Romanes, G. J. 1883.1; Willumsen, P. J. 1901.2; Faraday, F. J. Add. 1879.1.

Memory or retention. Retention of an acquired or habitual response during a period of its non-performance.

Habit formation; experiments on motor habits. — Pike learned not to dash into glass partition to secure prey on other side. Möbius, K. A. 1875.1. — Denial of such learning, in flounders. Bateson, W. 1889.1. — Repetition of Möbius's experiment. Triplett, N. 1901.1. — Labyrinth habit of *Fundulus*. Thorndike, E. 1899.1, Add. 1911.1. — Maze learning by goldfish. Churchill, E. P. Jr. in *Journ. Animal Behavior*, 1916, vol. 6, pp. 247-255.

Memory of colors, including color discrimination. The following experiments (★) involved the use of certain colored objects, papers, tubes, forceps, etc., enclosing food as a reward; other colors were not accompanied by food or were rendered disagreeable, as by Reighard. All observers agree in the retention of the associations formed. Frisch, K. 1913.1; Minkevich, R. 1912.1; Oxner, M. 1912.1-1912.5. Reighard, J. E. 1908.1; Uhlenhuth, E. 1911.1; Washburn, M. F. & Bentley, I. M. 1906.1; Zolotniskii, N. F. 1901.3; ★Goldsmith, M. Add. 1914.1; ★White, G. M. Add. 1919.1.

Memory of form or shape. Persists longer than color memory. Goldsmith, M. Add. 1914.1.

Memory of places and directions. (Topographic memory.) Miscellaneous, role in migrations, etc.; Franz, V. 1911.7, Add. 1913.2; Thierfelder, A. 1911.1; Zur Mühlen, M. 1911.19; Anon. 317. — Memory for nesting site in *Blennius* seems to be olfactory. Piéron, H. 1914.1. — Experiments. ★Goldsmith, M. Add. 1914.1.

Observations and anecdotes supposed to indicate the existence of memory. Baumgardt, G. 1904.1; Crivelli-Serbelloni, G. 1901.1; Dankler, M. 1902.1; Dantan, L. 1904.1; Landois, H. 1897.1; McIntosh, W. C. 1898.2; Parville, H. 1897.1; Reeker, H. 1898.1; Anon. 287; Giard, A. Add. 1897.1; J., J. Add. 1897.1. — Memory considered non-existent. ★Edinger, L. 1899.1, 1911.1.

Phototaxis and phototropism. Perception and reactions to white light.

Experiments. ★Hess, C. 1909.1, Add. 1913.1, 1914.1; Polimanti, O. 1912.4; Eisig, H. Add. 1884.3; Freytag, G. Add. 1914.1.

Light perception and reactions in—Amphioxus. Krause, W. 1897.1, 1898.2; Hesse, R. Add. 1898.1-3. — *Haplochilus*. Miehe, H. 1911.1, 2. — *Larval plaice*. Moore, B. 1909.1. — *Danio*. Mertens, R. 1915.1; Schulze, L. 1915.2. — *Periophthalmus*. Weve, H. 1913.1.

Integumentary nerves as photoreceptors. ★Parker, G. H. 1905.2, 1909.1, 2.

Reaction of eyeless (blinded) fish. Long, J. A. 1904.1. — *Reactions (negatively phototropic) of eyeless cave-fish, Amblyopsis.* ★Payne, F. 1907.1.

Phototaxis considered a product of normal reflexes under abnormal laboratory conditions. Franz, V. 1910.7, 8, 1911.1, 6, 8.

Influence of light upon periodical depth-migrations. Loeb, J. 1894.1, 1908.1. — *Influence on migrations of eel.* Petersen, C. G. 1907.1.

For the Biological significance of silvery coloration or lustre, in relation to phototaxis, see Miscellaneous under Coloration.

Rheotaxis and rheotropism. Response to water currents. Franz, V. 1910.7. — *An optical reflex.* Lyon, E. P. 1905.1, 1909.1. — *Relation of labyrinth and lateral line organs to rheotaxis.* Steinmann, P. 1913.1, 1914.1, Add. 1914.1.

For the evidently instinctive response of migrating salmon to the current, see Pacific salmon under Salmonidae. See especially, Rutter, C. 1902.1, 1904.1.

BLIND FISHES OF THE CAVES

For the blind fishes (par excellence) of Mammoth Cave, Kentucky, and of other caverns, see under Amblyopsidae.

General treatise: Cave vertebrates of America. ★Eigenmann, C. H. 1909.2.

Origin of cave faunas. Eigenmann, C. H. 1898.1; Garman, H. 1892.1; ★Packard, A. S. 1889.1, 1894.1; Loeb, J. Add. 1915.1.

Development and anatomy of the eye of cave fishes. ★Eigenmann, C. H. 1892.5-1901.2, Add. 1898.1, 1900.1; Eigenmann, C. H. & Denny, W. A. 1899.1; ★Kohl, C. 1895.1; Tellkamp, T. A. 1870.1; Wyman, J. 1851.1, 1854.5.

Gronias nigrilabris Cope, blind catfish of Pennsylvania. Cope, E. D. 1864.1.

Phreatobius cisternarum Goeldi, blind catfish of Marajo I., Brazil. Fuhrmann, O. 1905.5, 6; Goeldi, E. A. 1905.1.

Lucifuga and Stygicola (Brotulidae), blind fishes of the caves of Cuba. — *Eye, development.* Eigenmann, C. H. 1902.1, 2, 1903.1, 1912.1. — *Ovary, ova, ovarian gestation, etc.* Lane, H. H. 1903.1-1909.1. — *Original descriptions.* Poey y Aloy, F. 1851.1, 1865.1.

Typhlobagrus kronei (Ribeiro), blind catfish of Iporanga, Brazil. Haseman, J. D. 1911.2; Lönnberg, A. J. 1908.1. — See also Eigenmann in *Mem. Carnegie Mus.*, 1917, vol. 7, p. 255.

Typhlogobius californiensis Steindachner, blind goby of Point Loma, Cal. Eigenmann, C. H. 1890.6; Packard, A. S. 1894.1; ★Ritter, W. E. 1893.1; Smith, R. S. 1881.1.

*For a recent paper describing *Trogloglanis pattersoni*, a new blind catfish from an artesian well at San Antonio, Texas, see C. H. Eigenmann in *Proc. Amer. Philos. Soc.*, 1919, LVIII, 397-400.*

Recording (erroneous) one-eyed and blind fishes in cavern of Gabard in France. Montalembert, R. *Pré-Linn.* 1748.1.

Dr. G. A. Boulenger (*Revue Zool. Africaine*, 1921, vol. 9, pp. 252-253) has recently described an eyeless cyprinid (*Cæcobarbus geertsii*) related to *Barbus*, from the *Grotte de Thysville (Bas-Congo)*. This is the first record of a "blind fish" from other than American caverns.

BLOOD OF FISHES

For the circulation of the blood, see *Physiology under Circulatory system*.

General papers. — *Molecular concentration.* Frédéricq, L. 1901.1. — *Researches on normal and abnormal blood.* Hoffmeyer, C. W. 1907.1, Add. 1907.1. — *Comparative hæmatology.* Werzberg, H. 1911.1.

Coagulation of blood in fishes. Bottazzi, F. 1902.1; Delezenne, C. 1897.1; ★Nolf, P. 1906.1, 1909.1. — *Coagulation in Selachii.* Rodier, E. 1900.1, 2. — *Absence of autoagglutination in eel blood containing trypanosomes.* Sabrazès, J. & Muratet, E. 1909.1.

Origin and development of the blood. Aubert, H. 1855.1; Brigidi, V. & Tafani, A. 1878.1; Hoffmann, C. K. 1893.1; Mosso, A. 1888.5; Ziegler, H. E. 1889.1, 1892.1.

For a comprehensive treatise on the development of the blood, see ★Rückert, J. & Mollier, S. Add. 1906.1.

Chemical composition. *Miscellaneous papers.* Funke, O. 1852.1; Jones, J. 1856.1; Mitchell, S. W. 1858.1; Morin, B. 1829.1.

Chemical elements or compounds present in the blood of fishes. — *Glucose in blood of Selachii.* Diamare, V. & Montuori, A. 1907.1, 2. — *Copper content.* Dubois, R. 1900.1. — *Proteids.* Halliburton, W. D. 1886.1. — *Carbon dioxide content.* Nicloux, M. 1902.1. — *Urea in blood.* Rabuteau, A. R. & Papillon, F. 1873.1. — *Enzymes, lipase, and amylase.* Sellier, J. 1902.2, 3, 1904.1. — *Non-protein nitrogen.* Denis, W. Add. 1913.1.

MORPHOLOGICAL ELEMENTS of the blood

Erythrocytes or red corpuscles

Hemoglobin estimations (hemoglobinometry) and blood counts (hemocytometry) or numbers of erythrocytes in fishes. Harris, D. F. (*Skate*) 1903.1; Malassez, L. 1872.1; Marsh, M. C. & Gorham, F. P. 1906.1; Marsh, M. C. Add. 1902.1.

Development of the erythrocytes. *General researches on the origin and formation of erythrocytes in adult fishes, etc.* Camerano, L. & Salvadori, T. 1897.1; ★Downey, H. 1911.1; ★Giglio-Tos, E. 1897.2; Lereboullet, D. A. 1863.1, 1864.2. — *Role of spleen.* Phisalix, C. 1902.1. — *Role of thymus.* Schaffer, J. 1893.1.

Formation of red corpuscles in

"blood islands" in the yolk sac of the embryo fish.

For extensive studies of the formation of red corpuscles, see ★Stockard, C. R. 1915.1, 2.

Cyclostomata, Dipnoi, and Ganoidei. Mollier, S. 1906.1, Add. 1906.2. — *Petromyzon.* Ascoli, M. 1896.1, 1898.1, 1899.1; Giglio-Tos, E. 1897.1. — *Lepidosiren.* Bryce, T. H. 1904.1, 1905.1. — *Ceratodus.* Greil, A. 1908.1, 2, 1913.1.

Elasmobranchii. — *Selachii.* Maximow, A. 1910.1; ★Rückert, J. 1906.1; Stricht, O. 1896.2. — *Scyllium.* Mosso, A. 1888.4; Rouvière, — & Ladreyt, F. 1906.1. — *Torpedo.* Rückert, J. 1887.1; Swaen, A. 1885.1; Virchow, H. 1898.1.

Teleostei. Gensch, H. 1881.1, Add. 1882.1; Marcus, H. 1905.1; Mencl, E. 1910.1; Mollier, S. 1906.2; Wenckebach, K. F. 1885.1; Ziegler, H. E. 1887.1. — *Tylosurus.* Ryder, J. A. 1882.3. — *Salmonidæ.* ★Sobotta, J. 1894.1, 1902.1.

Morphology of red corpuscles, including their form or shape, size, etc. (Biconcave and circular in *Cyclostomata*, except *Myxine*, bi-convex and oval in all other fishes.)

For extensive papers dealing with the morphology of the red corpuscles, see ★Giglio-Tos, E. 1897.2, and ★Knoll, P. 1896.1.

Miscellaneous and general. Camerano, L. & Salvadori, T. 1897.1; ★Downey, H. 1911.1; Hammond, W. H. 1877.1, 2; Jones, T. W. 1846.1; Savory, W. S. 1869.1; Leeuwenhoek, A. *Pré-Linn.* 1702.2, 1709.1, 2.

Measurements or sizes of the erythrocytes. Cleland, J. B. & Johnston, T. H. 1912.1; Davy, J. 1846.1; Gulliver, G. 1845.1, 1846.1, 1848.1, 1862.1, 1875.1; Jakimov, V. D. & Kohl-Jakimova, N. 1912.1; Milne-Edwards, A., Jr. 1856.1. — *Salmonidæ.* Gulliver, G. 1872.3, (*Lamna*) 1872.4.

Structure, size, shape, etc., in Cyclostomata (Petromyzon). Camerano, L. 1896.1; Dekhuyzen, M. C. 1899.1; ★Gage, S. H. 1888.1, 2; Giglio-Tos, E. 1896.1, 2; Salvadori, T. A. 1896.1; Thompson, D. W. 1887.1.

Structure and form of erythrocytes in — Lepidosiren. Bryce, T. H. 1904.1, 1905.1. — *Polyodon.* Downey, H. 1911.1. — *Teleosts and Ganoids.* Rawitz, B. 1899.1, 1900.1. — *Torpedo.* Sabrazès, J. & Muratet, E. 1908.1. — *Protopterus.* Smith, A. & Gulliver, G. 1848.1. — *Amphioxus.* Huxley, T. H. Add. 1847.1.

Mobile granulations in red corpuscles of — Petromyzon. Giglioli, E. H. 1896.1. — *Hippocampus.* Sabrazès, J. & Muratet, E. 1900.1, 3. — *Anguilla.* Sabrazès, J. & Muratet, E. 1900.2, 1902.1, 1908.1.

Nucleus of red cells. Bonsdorff, E. J. 1855.2. — *Zoological import.* Gulliver, G. 1862.1.

Reticular structure of red corpuscles. Trinchese, S. 1878.1; Petrone, A. Add. 1914.1, 2.

Blood — Cont'd.**Leucocytes
or white corpuscles**

Histogenesis of leucocytes. Beard, J. 1900.1. — *in Lepidosiren.* ★ Bryce, T. H. 1904.1, 1905.1.

Morphology of white corpuscles. General researches. Drzewina, A. 1911.1; Lanine, P. 1912.1; Meinertz, J. Add. 1902.1.

Special forms of leucocytes. — *Nephrophagocytes in heart and kidney of Teleosts.* Cuenot, L. 1907.1, 1912.1. — *Eosinophiles.* Drzewina, A. 1910.1; Loewenthal, N. 1909.1; Stephan, P. 1906.1.

Eosinophiles are lacking in teleosts according to Sabrazès, J. & Muratet, E. 1900.4.

Physiology and functions of leucocytes. Phagocytosis. (The ingestion and digestion of micro-organisms by white corpuscles.) Mesnil, F. 1895.1; Ruediger, G. F. & Davis, D. J. 1907.1. — *In lymphorenal tissue, Polyodon.* Downey, H. 1910.1.

Phagocytosis in Hippocampus. Sabrazès, J. & Colombot, — 1894.1; Sabrazès, J. & Muratet, E. 1900.4.

Experimental physiological researches. — *Modification to variations in salinity of medium.* Drzewina, A. 1906.1, 1908.1. — *Behaviour in external media.* Quinton, R. 1898.1.

**Platelets
or thrombocytes**

Morphology and function. Eberth, C. J. 1887.1; Giglio-Tos, E. 1898.1; Sabrazès, J. & Muratet, E. 1908.1; Schwalbe, E. 1901.1. — *Phagocytic powers.* Ramon y Cajal, S. 1896.1.

BLOOD SERUM

Chemical composition. — *In Torpedo.* Baglioni, S. 1906.4. — *Nitrogen content.* Bottazzi, F. 1908.1, 2. — *Changes after bleeding in sharks.* Buijtendijk, F. J. 1909.2. — *Chemical composition, Salmonidæ.* Neresheimer, E. 1909.1. — *Ancestral features in blood plasma.* Macallum, A. B. Add. 1909.1.

Hemolytic and toxic effects of eel serum. This has a remarkably strong hemolytic action upon the erythrocytes of most animals (except the hedgehog) and a minute quantity (0.04 c. c.) when injected into the veins of a rabbit will cause hemolysis and death. The latter is caused apparently by the action of cytotoxins on the vasomotor and respiratory centers in the medulla.

For a recent valuable work in French, with an extensive bibliography, treating the entire subject of the toxic effects of the blood-serum of fishes, see ★Mafie Phisalix. "Animaux venimeux et venins." Paris. 1922, vol. II, pp. 537-580.

Effects upon "ichthyotoxin" of eel serum of alkalis, acids, dialysis, artificial digestion, heat, etc.; toxin considered a seralbumin. ★Mosso, A. 1888.2, 6, Add. 1888.1; Mosso, U. 1889.1, 2.

Various researches on the properties of

eel serum; toxicity, hemolytic or "globulicidal" action, acquisition of immunity against these effects, etc. ★Camus, L. & Gley, E. 1898.1-1905.1, Add. 1898.1; Doerr, R. & Raubitschek, H. 1908.1; Magliere, C. 1898.1; Springfield, A. 1889.1; Bellecci, A. & Polara, G. Add. 1907.1; Blanchard, R. Add. 1903.1; Cistovič, F. J. Add. 1899.1; Gley, E. Add. 1907.1; Héricourt, J. & Richet, C. Add. 1897.1, 2; Wehrmann, C. Add. 1897.1.

Immunization against toxic action, by injection of peptones. Clerc, A. & Læper, M. 1902.1, 2. — *Filtration of hemolysin.* Frouin, A. 1908.1. — *Prevention of hemolysis by action of sodium citrate.* Gengou, O. 1907.1, 2, Add. 1908.1.

Eel serum possesses property of immunizing venom of viper. Phisalix, C. 1896.1.

The injection of a dose of eel serum sufficient to kill a dog of 10 kgm. in a few minutes is without effect on a goldfish of 50 gm.; likewise serum of dog and ass have no effect when injected in goldfish. Scofone, L. & Buffa, E. 1900.1.

Effects of injection upon cardiac activities. Bardier, E. 1898.1. — *Effects of remote injections.* Héricourt, J. & Richet, C. 1898.1. — *Effect upon kidney cells.* Pettit, A. 1898.1, 1901. — *Antiproteolytic action.* Sellier, J. 1905.1, 1906.1. — *Effects upon mammalian eye.* Sterndorff, K. 1914.1. — *As a blood anti-coagulant.* Delezenne, C. Add. 1897.1.

Serum of eel is without effect when introduced into stomach of dog by way of mouth. Mosso, U. 1889.1; Mosso, A. Add. 1888.1. — *After similar feeding of rabbits for several months, post-mortem examinations show lesions similar to those produced by injections.* Jousset, P. & Lefas, — Add. 1904.1.

Toxic effects of sera of other fishes. In general these are not so pronouncedly toxic as in the eel.

Hemolytic and toxic effects of the blood serum of — Petromyzon. Buffa, E. 1900.1; Cavazzani, E. 1892.1, Add. 1892.1. — *Tinca.* Cignetti, F. 1900.1; Scofone, L. Add. 1904.1. — *Torpedo.* Gley, E. 1904.1. — *Thunnus.* Marcacci, A. Add. 1891.1, 1893.1. — *Various fishes.* Bellecci, A. & Polara, G. Add. 1907.1.

Effects of injection of mammalian blood serum in fishes. Scofone, L. & Buffa, E. 1900.1.

BRAIN

For the literature in which the brain and spinal cord are not clearly separable, see Central nervous system under Nervous system.

For the other component of the central nervous system, see Spinal cord.

Anatomy and morphology

General treatises on the comparative anatomy of the brain of vertebrates. Beltonci, G. 1880.1; ★Edinger, L. 1893.1, 1904.1, 1908.3; Haller, A. 1768.1, Add.

1768.1; His, W. 1892.2; ★Johnston, J. B. 1902.4; Serres, A. E. 1824.1; Guillot, N. Add. 1844.1.

Miscellaneous and general papers on the anatomy of the brain of fishes. Agassiz, J. L. 1844.7, 1845.4; Barbieri, C. 1905.1; Barteniew, L. 1867.1; Bonsdorff, E. J. 1855.1; Burckhardt, C. R. 1894.1, 3, 1897.2, 1906.2, Add. 1895.1; Duvernoy, G. L. 1852.1; Fenner, C. W. 1835.1; Franz, V. 1912.5; Fritsch, G. T. 1875.1, 1880.1; Hollard, H. L. 1866.2; Home, E. 1824.1; Miklukho-Maklai, N. N. 1868.1; Philipeaux, J. M. & Vulpian, E. F. 1852.1, 1853.1; Rabl-Rückhard, H. 1894.1; Steiner, J. 1886.5; Wilder, B. G. 1876.3.

Comparative anatomy of brain structures of fishes. Baudelot, E. 1870.1, 1873.1; Bonaparte, C. L. 1842.4; Edinger, L. 1888.1; Miklukho-Maklai, N. N. 1870.1. — *Ganoidei and Selachii.* Busch, W. 1848.1. — *Amphioxus and Craniates.* Delsman, H. C. 1913.1, Add. 1913.1. — *Salmo and Scyllium.* ★Haller, B. 1898.2. — *Teleostei and Selachii.* ★Kappers, C. U. 1904.1, 1906.1.

Anatomy of brain in various fishes. *Amphioxus.* Huxley, T. H. 1875.1.

Cyclostomata. — *Petromyzontidae.* ★Ahlborn, C. G. 1882.1, 1883.1. — *Ammocetes and Petromyzon.* Dendy, A. 1902.1; ★Johnston, J. B. 1902.3; Schilling, K. 1907.1; ★Tretjakoff, D. 1909.2, 1910.1, 1913.1; Wiedersheim, R. E. 1879.1, 1880.1; Wilder, B. G. 1876.3, 1877.4; Gage, S. P. Add. 1893.1. — *Ichthyomyzon.* Herrick, C. J. & Obenchain, J. B. 1913.1. — *Myxine.* Retzius, M. G. 1893.1; Wilder, B. G. 1876.3, 1877.4. — *Bdellostoma.* ★Worthington, J. 1905.2.

Dipnoi. — *Neoceratodus.* Beauregard, H. 1883.1; Sanders, A. 1888.1, 1889.1; Wilder, B. G. 1887.1. — *Protopterus.* ★Fulliquet, G. 1886.1; Serres, P. M. 1863.1.

Elasmobranchii. Burckhardt, C. R. 1898.1; Duméril, A. M., Flourens, M. J. & Duvernoy, G. L. 1854.1; Rohon, J. V. 1877.1; Wallenberg, A. 1907.1, 1907.2. — *Isistius.* Burckhardt, C. R. 1902.1. — *Scymnus.* Burckhardt, C. R. 1907.1. — *Scyllium.* Haller, B. 1898.2. — *Galeocerdo.* Haswell, W. A. 1883.1. — *Echinorhinus.* Jackson, W. H. & Clarke, W. B. 1876.1. — *Chimæra.* Kappers, C. U. & Carpentier, F. W. 1911.1; Miklukho-Maklai, N. N. & Gegenbaur, C. 1870.1; Tanaka, S. 1877.1; Wilder, B. G. 1877.3, 7, 1908.1. — *Dicerobatis.* Panceri, P. & Sanctis, L. 1869.1. — *Acanthias.* Sander, J. 1867.1; Wyman, J. 1848.1. — *Mustelus.* Wilder, B. G. 1876.3, 1877.4; Mitsukurina. 1905.1, 3; *Chlamydoselachus and Scymnus.* 1905.3; *Cestacion and Pristiophorus.* 1907.1.

Retia mirabilia in brain of Dicerobatis. Sanctis, L. 1868.1.

Brains of Plagiostomes figured. Garman, S. 1913.1.

Ganoidei. Herrick, C. J. 1891.2. — *Amia.* Gage, S. P. Add. 1893.1. — *Poly-*

odon. Garman, H. 1896.1; Wilder, B. G. 1876.2, 1877.4. — *Acipenser.* Goronowitsch, N. 1888.1; Herrick, C. J. 1902.3; ★Johnston, J. B. 1902.2; Stannius, F. H. 1843.1; Wilder, B. G. 1876.2, 1877.4. — *Amia and Lepidosteus.* Kappers, C. U. 1907.1; Wilder, B. G. 1876.2, 1877.4, 1912.1, Add. 1893.1.

Teleostei. Gottsche, C. M. 1834.1, 1835.2; ★Herrick, C. L. 1891.1, 1892.1, Add. 1892.1; Malme, G. O. 1892.1; Rabl-Rückhard, H. 1884.1, 1885.1, Add. 1885.1; Ramon y Cajal, S. 1894.2; ★Wallenberg, A. 1907.1, 2. — *Mormyridæ.* Ecker, A. 1854.1; Erdl, M. P. 1846.1; ★Franz, V. 1911.5; ★Marcusen, J. 1862.1, 1864.1; Oeffinger, H. 1867.2; Sanders, A. 1882.1, 1883.1; Stendell, W. 1914.2. — *Cyclothone.* ★Gierse, A. 1904.1. — *Salmo.* Haller, B. 1898.2. — *Siluridæ.* Herrick, C. J. 1891.1; Neumayer, L. 1908.1. — *Carassius.* Hirsch, J. 1912.1; Savouré, P. 1911.2. — *Cyprinidæ.* ★Mayer, P. 1882.1. — *Amblyopsis.* Ramsey, E. E. 1909.1. — *Tinca.* Rusconi, M. 1846.1. — *Idus and Squalius.* Savouré, P. 1911.1; *Leuciscus.* 1911.1. — *Esox.* Stieda, L. 1861.1. — *Deep sea fishes (Bassozetus, Mixonus, and Leucicorus).* Trojan, E. 1906.1. — *Triglidæ.* Tiedemann, D. F. 1816.2. — *Orthogoriscus.* Vignal, W. V. 1881.1. — *Lophius.* Wyman, J. 1854.1; *Cyclopterus.* 1854.4. — *Luvarus.* Haller, B. Add. 1881.1.

Commissures of the brain. — *Superior commissure, fore-brain.* Cameron, J. 1904.1. — *Commissural system, Teleosts.* Gottsche, C. M. 1833.1; Herrick, C. L. 1891.1. — *Commissura infima, hind-brain.* Herrick, C. J. 1908.1. — *Cerebral commissures.* Osborn, H. F. 1887.1. — *Commissural fibers of prosencephalon, Selachii.* Romano, A. 1897.1.

Choroid plexus. — *Development in Torpedo.* Gentes, L. 1906.1, 1908.1. — *Secretory function.* Pettit, A. & Girard, J. 1902.1, 2.

Development. Edinger, L. 1896.1; His, W. 1894.2; Hollard, H. L. 1866.1, 1866.3. — *Ammodytes.* Fullarton, J. H. 1895.2. — *Clupea.* Holt, E. W. 1891.3. — *Acanthias.* Meek, A. 1909.1. — *Teleosts.* Rabl-Rückhard, H. 1882.1, 2. *Tinca.* Weber, E. H. 1846.1. — *Selachii.* Wilder, B. G. 1876.1.

Evolution and phylogeny. Bothe, A. 1899.1; Gaskell, W. H. 1898.1 (i); Goette, A. 1883.1; Locy, W. A. 1905.1; Smith, G. E. 1910.1.

For segmentation in the formation of the brain, see under Metamerism.

Histology and histogenesis of brain. *For comprehensive treatises on the comparative histology of the selachian and teleostean brain, see* ★Kappers, C. U. 1904.1, 1906.1.

Miscellaneous and general. Ayers, H. 1896.1; Baudelot, E. 1869.4, 5, 6; ★Catois, E. H. 1899.1, 2, 1901.1, 1902.1;

Brain — *Cont'd.*

Fritsch, G. T. 1875.2, 1876.1, 1878.2;
Fusari, R. 1887.1,3.

In various groups of fishes. — *Cyclostomata*. Jelenoff, A. 1879.1 (*Petromyzon*); Röthig, P. & Kappers, C. U. 1914.1 (*Myxine*). — *Elasmobranchii*. ★Houser, G. L. 1897.1, 1901.1; Sauerbeck, E. 1896.1; Viault, F. 1876.1. — *Ganoidei*. Herrick, C. J. 1891.2. — *Teleostei*. Bellonci, G. 1879.1; Franz, V. 1913.1 (*Mormyrus*); Herrick, C. L. 1891.1, 1892.1,2; Sanders, A. 1878.1; Saviouré, P. 1912.2 (*Cyprinids*); Vignal, W. V. 1881.1 (*Orthagoriscus*).

Physiology, functions of the brain. Barbieri, C. 1905.1; Baudelot, E. 1863.1; Harting, P. 1864.5; Lussana, F. & Lemoigne, A. 1871.1; Traube-Mengarini, M. 1884.1; Treviranus, G. R. 1820.1.

DIVISIONS OF THE BRAIN

TELENCEPHALON

or Fore-brain

For a recent extensive memoir on the comparative morphology of the fore-brain in fishes, see Nils Holmgren, Journ. Comp. Neurol., 1922, vol. 34, pp. 391-460.

Morphology. Burckhardt, C. R. 1894.4; ★Johnston, J. B. 1909.3; Kappers, C. U. & Theunissen, W. F. 1907.1; Rabl-Rückhard, H. 1894.2; ★Studnička, F. K. 1894.1-1895.1, 1898.2.

Morphology in various groups of fishes. — *Elasmobranchii*. Bottazzi, F. 1894.1, 1895.1; Crisafulli, E. 1901.1 (*Scyllium*); ★Johnston, J. B. 1911.2. — *Cyclostomata and Ganoidei*. Johnston, J. B. 1911.1, 1912.1. — *Teleostei*. Goldstein, K. 1905.1; ★Johnston, J. B. 1911.1, 1912.2,3. — *Dipnoi (Lepidosiren)*. Smith, G. E. 1908.1.

Histology, development, and function. — *Histology of fore-brain*. Edinger, L. 1894.1; Johnston, J. B. (*Acipenser*) 1898.2. — *Function of fore-brain in Petromyzon*. Edinger, L. 1905.1. — *Development*. Fuchs, F. 1908.1; Johnston, J. B. (*Cerebral cortex*) 1910.2.

Corpus striatum, the basal ganglionic portion of the walls of the Telencephalon. — *Structure, function and phylogeny*. Edinger, L. 1887.1, 1894.1; Kappers, C. U. 1908.2.

Cerebral hemispheres of fishes. — *Anatomy and morphology*. Kappers, C. U. 1911.1; Kemna, A. 1904.3; Klaatsch, H. M. 1850.1; Wittzack, J. C. 1817.1. — *Selachii*. Bottazzi, F. 1894.1, 1895.1. — *Teleosts*. Herrick, C. L. 1892.2; Keller, O. 1906.1; Rabl-Rückard, H. 1883.1; Steiner, J. 1886.6; Wilczewski, 1838.1 (*Cyprinus*).

Histology, development and function. — *Histology*. Bottazzi, F. 1893.1. — *Development*. Haller, B. 1908.1; Studnička, F. K. 1901.2. — *Persistence of voluntary movements after removal*. Vulpian, E. F. 1886.1,2.

Olfactory lobes, thickenings of dorsal, lateral, and frontal walls of fore-brain. — *Anatomy and morphology*. Bellonci, G.

1882.2; Eichholtz, I. H. 1841.1; Kamon, K. 1904.1; Wilder, B. G. Add. 1898.1. — *Teleosts*. Bellonci, G. 1887.1. — *Selachii*. Rabl-Rückhard, H. 1893.1.

Histology and histogenesis. Barbieri, C. 1905.2; Bellonci, G. 1887.1. — *Selachii*. Bottazzi, F. 1894.1; Catois, E. H. 1897.1. — *Acipenser*. Johnston, J. B. 1898.2. — *Cyprinidae*. Saviouré, P. 1912.3. — *Analysis of olfactory tracts and centers*. ★Sheldon, R. E. 1908.1, 1912.1.

Paraphysis, a tube or sac in the roof of the fore-brain. — *Anatomy*. Erchia, F. 1896.1; Kingsbury, B. F. 1897.1; Rohon, J. V. 1900.2; Studnička, F. K. 1895.4, 1900.2.

Development, Amia. Eycleshymer, A. C. & Davis, B. M. 1897.1.

DIENCEPHALON

Inter-brain or Thalamencephalon

Morphology and phylogeny. Burckhardt, C. R. 1894.2. — *Optic thalamus, structure*. Gottsche, C. M. 1833.2. — *Thalamus, phylogeny*. Kappers, C. U. 1908.2.

Anatomy in various groups of fishes. — *Selachii*. Edinger, L. 1895.1. — *Teleostei*. Franz, V. 1912.2; ★Goldstein, K. 1905.1; Keller, O. 1906.1.

Epiphysis cerebri. (Called also pinealis and pineal body or gland.)

For the most extensive treatises on the anatomy and histology of the epiphysis in fishes, see ★Cattie, J. T. 1881.1-1883.1.

Anatomy and morphology. Dendy, A. 1907.2; Jaekel, O. 1903.3; Julin, C. 1887.1; ★Leydig, F. 1896.2; Minot, C. S. 1901.1.

Morphology of epiphysis in various groups of fishes. — *Cyclostomata (Geotria and Petromyzon)*. Dendy, A. 1907.3; Sterzi, G. 1905.1; Whitwell, J. R. 1888.1. — *Dipnoi and Ganoidei (Protopterus, Polyodon, Amia)*. Burckhardt, C. R. 1891.2; Garman, H. 1896.1; Hill, C. 1894.1; Kingsbury, B. F. 1897.1. — *Elasmobranchii*. Cattie, J. T. 1881.1,2, 1882.1; Ehlers, E. H. 1878.2; Purvis, G. C. (*Lamna*) 1892.1. — *Teleostei*. Hill, C. 1894.1; Klinckowström, A. (*Callichthys*) 1893.2; Terry, R. J. 1910.1.

Development of epiphysis. Julin, C. 1887.1. — *Amia*. Davis, B. M. 1896.1; Eycleshymer, A. C. & Davis, B. M. 1897.1. — *Coregonus*. Hill, C. 1891.1. — *Acanthias*. Minot, C. S. 1901.1.

Summary of literature concerning epiphysis. Davis, B. M. 1896.1.

Functions of epiphysis. Ahlborn, F. Add. 1884.1.

Pineal eye of Cyclostomata (called also Parietal eye), an organ with a close resemblance to an eye, possessing a retina and in some cases a lens. In the adult lamprey, two vesicles, a dorsal "pineal" and a ventral "parapineal" overlie the roof of the thalamencephalon. According to Studnička, these organs develop as evaginations of the brain roof, the parapineal anteriorly.

General discussions. Favaro, G. & Mozejko, B. 1913.1; Leydig, F. 1887.1,

1896.2; ★Studnička, F. K. 1893.1, 3, 1900.2, 1905.1.

Various papers on the morphology and development. Ayers, H. 1891.1; Beard, J. 1887.1, 1888.6; Cope, E. D. 1888.2; Dendy, A. 1899.1; Frisch, K. (*Functions*) 1912.2; Locy, W. A. 1893.1; Ovsyannikov, F. V. 1891.1; Rohon, J. V. 1900.2; Carrière, J. Add. 1890.1.

Morphology in Geotria. ★Dendy, A. 1907.1, 1907.2, 3. — *Mordacia*. Spencer, W. B. 1890.1. — *Myxine*. Studnička, F. K. 1899.6. — *Petromyzon*. Ovsyannikov, F. V. 1888.1, 1889.2; Retzius, M. G. 1895.4; Studnička, F. K. 1893.2, 1899.3; ★Tretjakoff, D. 1915.1.

Hypophysis cerebri, or pituitary body. An ectodermal diverticulum from the roof of the oral cavity; not properly a brain structure, but by common consent placed here.

Anatomy and morphology. ★Haller, B. 1898.1; Jaekel, O. 1903.3; Müller, W. Add. 1871.1 (ii); Stendell, W. Add. 1913.1. — *Lateral lobes*. Gentes, L. (*Torpedo*) 1908.4; Rossi, U. (*Selachii*) 1903.1. — *Glandular lobe*. Gentes, L. 1903.1. — *Posterior lobe*. Joris, H. 1908.1.

Anatomy in various fishes. — *Calamoichthys*. Bickford, E. 1895.1. — *Centroscyrnus*. Pettit, A. 1906.1. — *Myxine*. Retzius, M. G. 1895.5. — *Petromyzon*. Sterzi, G. 1904.2, 3. — *Chimæra*. Aresu, M. Add. 1914.1.

Development. Goette, A. 1883.1; ★Müller, W. Add. 1871.1 (ii).

Development in various groups of fishes. *Cyclostomata* (*Petromyzon*). Scott, W. B. 1883.1; Sterzi, G. 1904.3. — *Elasmobranchii*. Chiarugi, G. (*Torpedo*) 1898.1, 1905.1; Gentes, L. (*lobes in Torpedo*) 1908.2-5; Herring, P. T. 1911.1. — *Ganoidei* (*Amia*). Prather, J. M. 1900.1; Reighard, J. E. 1900.2; Reighard, J. E. & Mast, S. O. 1908.1; Smith, P. E. 1914.1. — *Teleostei*. Boeke, J. (*Muraenidae*) 1903.1; Lundborg, H. 1894.1.

Histology. Studnička, F. K. 1901.1; ★Stendell, W. Add. 1913.1; Tilney, F. Add. 1911.1.

Phylogeny. Dohrn, F. A. (*Petromyzon and Teleostei*) 1882.1, 2 (ii & iii); Stendell, W. 1914.1; Ayres, H. Add. 1907.1.

Varia. — *Structure*, Rathke's pocket. Albrecht, P. 1884.2. — *Action of extracts of hypophysis*. Herring, P. T. 1908.1, 2. — *Relation of hypophysis to notochord, shark embryos*. Rabl-Rückhard, H. 1880.1.

Infundibulum, a funnel-shaped out-pushing of the floor of the diencephalon. *Morphology and homology.* Boeke, J. (*Amphioxus*) 1902.3, 1908.1, 1914.1; Gemelli, F. A. 1906.1; ★Haller, B. 1898.1.

Development. — *Muraenidae*. Boeke, J. 1901.1, 1902.1. — *Torpedo*. Gentes, L. 1908.1. — *Petromyzon*. ★Sterzi, G. 1904.3.

Lobi inferiores, or bilobed expansions of the ventral walls of the diencephalon. *Morphology.* Chatin, J. 1889.1. — *Ganooids and Teleosts*. ★David, J. J. 1892.1.

Saccus vasculosus, a vascular sac in

the floor of the third ventricle. *Morphology and function.* — A receptive nervous organ, not a gland. Boeke, J. & Dammerman, K. W. 1910.1. — A depth organ, morphology. ★Dammerman, K. W. 1910.1. — *Development*. Lundborg, H. 1894.1.

MESENCEPHALON or Mid-brain

Anatomy, development, and physiology. Erchia, F. 1896.1. — *Teleosts*. ★Franz, V. 1912.2. — *Teleostei and Ganoidei*. Miklukho-Maklai, N. N. 1870.1. — *Zoarces*. Pedaschenko, D. 1901.1, *Development of mid-brain*. 1901.2. — *Mesencephalon as center for sense of equilibrium*. Reisinger, L. 1915.1.

Optic lobes, paired thickenings of the dorsal wall of the mid-brain. *Anatomy.* Eichholtz, I. H. 1841.1; Manouélian, Y. 1899.1. — *Teleosts*. Auerbach, L. 1888.1, 1889.1; Philipeaux, J. M. & Vulpian, E. F. 1865.1; ★Radl, E. 1915.1. — *Eyeless cave-fish, Amblyopsis*. Ramsey, E. E. 1901.1.

Histology. ★Barbieri, C. 1905.2, 1906.1; Bellonci, G. 1883.1; Ramon y Cajal, P. 1899.1.

Functions of optic lobes. Gómez Ocaña, J. 1908.1.

Tectum opticum, that portion of the mid-brain which roofs over the optic vesicle. *Anatomy and histology.* Aichel, O. 1901.1; Bellonci, G. 1880.2, 1882.1.

Torus longitudinalis, a grooved ridge in the median portion of the roof of the mesencephalon. *Morphology, phylogeny, etc.* Rabl-Rückhard, H. 1887.1; Sala, L. 1895.1; ★Sargent, P. E. 1903.2.

METENCEPHALON or Cerebellum

Anatomy and morphology. Bellonci, G. 1879.2; ★Burckhardt, C. R. 1879.1; Edinger, L. 1910.1; Falcone, C. 1893.1; Gurewitsch, M. J. 1905.1; Schaper, A. 1899.3; Treviranus, G. R. 1831.1. — *Corpus restiforme*, a structure in the cerebellum. Gehuchten, A. 1904.1.

Of various fishes. — *Petromyzon*. Clark, W. B. 1906.1. — *Scyllium*. Edinger, L. 1901.1. — *Teleosts*. Franz, V. 1911.4. — *Acipenser*. ★Johnston, J. B. 1898.1. — *Mormyridae*. Stendell, W. 1914.4.

Histology and histogenesis. — *Teleosts*. Baudelot, E. 1869.4; Ovsyannikov, F. V. 1864.2; ★Schaper, A. 1893.1, 1894.1, *Petromyzontidae*. 1899.2, *Mustelus*. 1898.1.

Functions. — *Static function in larvæ*. Franz, V. 1912.3. — *As center for sense of equilibrium*. Reisinger, L. 1915.1.

MYELENCEPHALON or Medulla oblongata

Anatomy. ★Kingsbury, B. F. 1897.2; Meckel, J. F. 1836.1. — *Cyprinidae*. Savouré, P. 1912.1.

Histology. Ovsyannikov, F. V. 1854.1. — *Petromyzon*. David, J. 1892.1. — *Acipenser*. ★Johnston, J. B. 1898.1, 2. — *Myxine*. Röthig, P. 1913.1. — *Lophius*. Zuikov, V. P. 1898.1.

Brain — *Cont'd.*

Physiology. — *Gustatory center.* Herrick, C. J. 1905.1, 1906.1; *Tactile center.* 1906.1; *Tactile center, Prionotus.* 1907.3. — *General center for orientation.* Polimanti, O. 1915.1. — *Effects of sectioning upon orientation.* Loeb, J. Add. 1891.1.

Generalia. — *Fasciculus communis system, Bdellostoma.* Ayres, H. & Worthington, J. 1908.1. — *Entrance of cranial nerves, Amia.* Droogleever Fortuyn, A. B. 1913.1. — *Entrance of motor nerves in Amia.* Fortuyn, A. B. 1912.1. — *Funicular nuclei.* Herrick, C. J. 1906.2, 1907.2. — *Vagal lobes in Gadus.* 1907.2. — *Accessory lobes, Orthogoriscus.* Vignal, W. V. 1886.1.

For electric lobes, centers of the electric nerves in *Torpedo*, see under *Electric fishes*.

INCERTÆ SEDIS

Various unclassifiable items. — *Nerve center connected with posterior bundle, commissure of Haller in Gasterosteus.* Baudelot, E. 1869.2. — *Degeneration of brain, Scyllium, (experimental researches).* Fornario, G. 1894.1. — *Eversion and inversion of parts.* Kappers, C. U. 1908.1. — *Weight of brain in relation to size of eye.* Lapique, L. 1908.1; Lapique, L. & Laugier, H. 1908.1.

Nomenclature of cavities. Parker, T. J. 1889.1. — *Significance of parts.* Stieda, L. 1873.2, 5. — *Arrangement motor roots and nuclei, Acipenser and Lepidosteus.* Theunissen, F. 1914.1.

Review of brain casts of various fossil fishes. Moodie, R. L. 1915.2. — *Brain casts of Eocene Siluroids.* Neumayer, L. 1913.1. — *Brain structures of various fossil fishes.* Eastman, C. R. Add. 1913.1.

CHEMISTRY (BIOLOGICAL AND PHYSIOLOGICAL)

The great majority of the experiments and researches of the biological chemists have been performed with subjects other than fishes. The following titles represent the subjects, in so far as they are known to us, wherein their investigations have touched upon the subject of fishes.

Reference may advantageously be made to the standard text books of physiological chemistry, such as Mandel's translation of Hamnersten and Hedin.

For topics primarily physiological, such as anabolism, katabolism, and urea formation; for effects upon fishes of acids, alkaloids, salts in solution, and other foreign substances, see under *Physiology*.

For the nature of the gaseous content of the air bladder, see under *Air bladder*.

For the nature of pigments, see under *Coloration*.

For the composition of fish guano and cod-liver oil, see *Fertilizer*, and *Oils below Economic products under Fisheries*.

For albumen, basic proteins, nucleic acid, etc., in ova; composition of egg-cases of sharks, etc., see under *Ova and ovum*.

For histones and protamines, see *Chemical composition under Spermatozoa*.

For the occurrence of guanin in the skins of fishes, see *Argenteum under Integument*.

Guanin in retinal epithelium. Cunningham, J. T. & MacMunn, C. 1893.1; Kühne, W. & Sewall, H. 1880.1.

Glycogen in various tissues, especially in the liver and muscles. Blanchard, R. 1882.1; Bottazzi, F. 1907.1; Gage, S. H. 1905.2; Schöndorff, B. & Wachholder, K. 1914.1; Bernard, C. Add. 1879.1; Brammertz, W. Add. 1914.1.

Chlorine, variations according to medium, in Cobitis. Calugareanu, D. 1910.1, 2.

Iodine content of thyroids. Cameron, A. T. 1913.1, Add. 1914.1.

Absence of glycogen and sugar in electrical organs of Torpedo. Dubois, R. 1899.1.

Analysis of the urine in various fishes. Buijtendijk, F. J. 1909.1; Davy, J. 1857.2; Dekhuyzen, M. C. 1904.2; ★Denis, W. 1912.1, Add. 1913.1; Heinroth, O. 1895.2; Jones, J. 1856.1; Ubalini, G. 1871.1.

Composition of pathological calculi, chiefly intestinal. Delachanel, B. & Mermet, A. 1874.1; Fourcroy, A. & Vauquelin, L. 1807.1; Harting, P. 1875.2. — *Biliary calculi in squeteague.* Tower, R. W. 1902.1.

Ichthyolepidin in fish scales. Green, E. H. & Tower, R. W. 1902.1, 2; Mörner, C. T. 1898.1, 1902.1.

Red color of salmon flesh due to lipochrome pigment related to tetron or zoonerythrin. Newbigin, M. I. 1900.1. — *Review of this.* Prince, E. E. 1916.2.

Bile of fishes, composition. Otto, R. 1867.1; Scherer, J. 1857.1; Schlossberger, J. 1858.1; Zanetti, C. U. 1902.1.

Crystalline lens, composition. Payen, A. 1857.1; Valenciennes, A. & Fremy, E. 1854.3.

Mucous secretions of the skin of the hag-fish Myrine, composition. Reid, E. W. 1893.1, 1894.1.

Percentage of water in brain of dogfish. Scott, G. G. 1912.1, 1914.1.

Nitrogen distribution in liver of Acipenser. Wakeman, A. J. 1905.1.

Scyllite from spleen of sharks. Müller, J. Add. 1907.1.

Composition of cartilage in sharks and rays. Bunge, G. 1899.1; Chevreul, M. E. 1811.1, 2; Harting, P. 1873.2; Lönnberg, J. 1884.1; Marchand, R. F. 1836.1; Soxleth, F. & Petersen, P. 1873.1.

Composition of subdermal connective tissue of Mola. Green, E. H. 1901.1.

Fat or adipose tissue. *Metabolism, etc.*

Studies on the fat and fat-cells of fishes: composition, histology, etc. Giles, A. E. 1890.1; Mottram, V. H. 1912.1; Nemiloff, A. 1906.1; Rosenfeld, G. 1912.1; Weill, J. 1914.1; Zdarek, E. 1902.1; Zuntz, N. 1903.1; Leeuwenhoek, A. Pre-Linn. 1724.1.

Fat-storage in muscles of the salmon: metabolism, absorption during migrations, etc. Greene, C. W. 1912.1-6; Mahalanobis, S. C. 1898.1.

Fat content of Selachian liver: its role

during pregnancy, etc. Bottazzi, F. 1907.1; Polimanti, O. 1912.6, 1913.4; Reach, F. 1912.1.

Amount of fat in different fishes, in relation to their comestible value. Payen, A. 1834.1-1865.1; Fage, L. & Legendre, R. Add. 1914.1; Hughes, F. Add. 1891.1.

Analysis of fish flesh

Changes in flesh of herring during reproductive period. Milroy, T. H. 1908.1.

Characteristic odor of sea-fish flesh. Panzer, T. 1910.1.

Fluorine in tissue. Gautier, A. & Clausmann, P. 1913.1. — Urea in shark flesh. Krukenberg, C. F. 1888.1. — Sulphur content of flesh. Schulz, H. 1893.1. — Nitrogen content of dried codfish. Yoshimura, K. & Kanai, M. 1913.1.

Chemical analyses of the flesh of fishes, chiefly from the viewpoint of the relative percentages of proteids, fat, carbohydrates, ash, water, waste, etc. Almen, A. 1877.1; Balland, M. 1898.1; Calderwood, W. L. 1904.4; Chittenden, R. H. 1877.1; Christison, R. 1872.1; Frédéricq, L. 1901.1, 1905.1; Kensington, E. T. 1884.1; Lebedintsev, A. A. 1905.2; Morin, B. 1822.1; Payen, A. 1834.1-1865.1; Payen, A. & Wood, — 1854.1; Stirling, W. 1885.1; White, G. F. & Thomas, A. 1914.1; Weidenbusch, H. 1847.1; Zuntz, N. 1903.1; König, J. & Splittgerber, A. Add. 1909.1.

For additional references of a similar nature, see Nutritive value below Economic products under Fisheries.

For the chemical composition of young eels under various conditions of nutrition or starvation, see Reuss, H. & Weinland, E. 1912.1.

At many places in France, the transparent stages (*Leptocephali*) of the eel are eaten under the names of "Civelles" and "Piballes." Their food value because of their fat content is relatively greater than other older stages, according to Vaillant, L. L. 1903.3.

Extractive bodies. In fishes, the nitrogenous extractives of the muscles (flesh) consist chiefly of creatine and creatinine.

Various papers. Baglioni, S. 1906.3, 4; Krukenberg, C. F. 1881.1, 2, Add. 1881.2; Suwa, A. (*Trimethylaminoxid*) 1909.1, 2; Suzuki, U., Mihata, M., Otsuki, S. & others 1912.1; Wilson, D. W. & Lyman, J. F. 1913.1; Buglia, G. & Costantino, A. Add. 1913.1; Okuda, Y. Add. 1912.1.

Discovery of nitrogenized protic acid in *Cyprinid*, *Rutilus*. Limpricht, H. 1863.1. — Review of this. Harting, P. 1863.2.

Isocreatinine in extractives. Discovered by Thesen, J. E. 1898.1. — Considered an impure creatinine by Poulsson, and by Schmidt & Korndörfer, in *Arch. f. exp. Path. u. Pharm.*, vol. 51.

CIRCULATORY OR VASCULAR SYSTEM

Comprising the blood vascular system of fishes, including arterial, venous, and lymphatic systems.

Both Heart and Blood, essential parts of the vascular system, are treated separately because of the large number of citations under each.

For an authoritative, readable article on the vascular system, see the chapter in ★Bridge, T. W. 1904.1.

Origin and evolution of the circulatory system. Cahall, W. C. 1891.1; Lankester, E. R. 1873.3.

Anatomy and morphology. Miscellaneous papers. Harting, P. 1857.1; Hyrtl, C. J. 1844.1, Add. 1838.1; Sabatier, C. P. 1873.1; Sède de Liéoux, P. 1886.1. — Relation of blood and lymph vessels to the "Saftkanälchen." Arnold, J. 1875.1.

Anatomy of circulatory system in — *Amphioxus*. Legros, R. 1900.1, 1902.1; Martino, A. 1846.2; Možeyko, B. 1912.2, 1913.3, 5.

Cyclostomata. — *Ammocoetes*. ★Cori, C. J. 1906.1; Dohrn, F. A. 1882.2 (xiii); Julin, C. 1888.1. — *Petromyzon*. Favaro, G. 1905.1; Možeyko, B. 1910.1, 2, 1911.3, 1912.3-1912.5. — *Bdellostoma*. Jackson, C. M. 1901.1. — *Heptatrema*. Kirk, H. B. 1912.1.

In various fishes, chiefly *Teleosts*. — *Loricati*. ★Allen, W. F. 1905.1. — *Amphipnous*. Hyrtl, C. J. 1858.3. — *Amiurus*. Mackenzie, T. 1884.1. — *Lota*. Melnikov, N. 1866.1. — *Lepidosteus*. Mitchell, S. W. 1860.1. — *Mustelus*. Parker, T. J. 1886.1. — *Selachii*. Robin, C. P. 1845.2. — *Plectognaths*. Rosén, N. 1912.1 (i). — *Lopholatilus*. ★Silvester, C. F. 1904.1. — *Ceratodus*. Spencer, W. B. 1893.1. — *Monopterus*. Volz, W. 1905.1, 5, 1906.1.

Development and embryology. For recent comprehensive general treatises on the development of the blood circulatory system see ★Hochstetter, — Add. 1906.1 and ★Rückert, J. & Mollier, S. Add. 1906.1.

Miscellaneous papers. Brigidi, V. & Tafani, A. 1878.1; Reichert, C. B. 1858.1.

Development of blood vessels in *Cyclostomata*. ★Hatta, S. 1908.1; Keiser, W. Add. 1914.1; ★Mollier, S. Add. 1906.2.

Development in *Elasmobranchii*. Hoffmann, C. K. 1893.2; ★Mayer, P. 1887.1, 1888.1, 1894.1; Raffaele, F. 1891.1; ★Rückert, J. 1888.1, 1906.1; Virchow, H. 1895.2, 1897.1, 1898.1; Thompson, A. Add. 1831.1. — *Torpedo*. Emmert, J. 1900.1. — *Acanthias*. Hoffmann, C. K. 1892.1. — *Yolk-sac circulation, development in Scyllium*. Hochstetter, F. 1905.1; Virchow, H. 1897.1. — *Sinus terminalis, Torpedo*. Rückert, J. Add. 1903.1.

Dipnoi and *Ganoidei*. Mollier, S. 1906.1, Add. 1906.2. — *Ceratodus*. ★Greil, A. 1908.1, 2, 1913.1; Kellicott, W. E. 1904.1, 1905.1. — *Lepidosiren*. ★Robertson, J. I. 1913.1. — *Lepidosteus*. Virchow, H. 1894.1.

Teleostei. Borcéa, J. 1909.1, 1910.1; Filippi, F. 1845.2; Grochmalicki, J. 1910.1; Mollier, S. 1906.2. — *Salmonidæ*. ★Sobotta, J. 1894.1, 1902.1; Ziegenhagen, P. 1894.1, (*Belone*) 1896.1.

Vascular endothelium (the epithelial cells lining the blood vessels and lymphatics).

Circulatory Syst. — Cont'd.

Origin, development and structure — In branchial vessels. Biétrix, E. 1895.2,3. — *Kupffer's cells of endothelium of liver.* Nathan, M. 1908.1. — *Of intestinal veins, Selachii.* Neuville, H. 1900.1. — *Development from mesenchymal cells.* ★Stockard, C. R. 1915.1,2.

Origin of cardiac endothelium. Nöldeke, B. 1899.1; Rückert, J. 1887.2, 1888.1.

Vascular system of various regions.

Dohrn's sinus in the tail region of Petromyzon. Dohrn, A. 1882.2 (xiii); Možeyko, B. 1911.1,2, 1912.5; Vogt, C. C. & Yung, E. 1888.1.

Retia mirabilia, networks of small blood vessels found in — Liver of Thynnus and intestinal wall of Alopias. Eschricht, J. F. & Müller, J. 1835.1,2. — *Spiral valve of sharks.* Duvernoy, G. L. 1833.1; Neuville, H. 1897.3, 1901.1. — *Spleen, Selachii.* Pouchet, G. 1882.1.

For other retia mirabilia, arterial or venous vascular networks, found in various organs, see under Air-bladder, Brain, and Eye (Choroid Gland).

For a general account of Retia mirabilia, the "Wundernetze," see Müller, J. 1840.4.

Lacunæ in branchial region. Biétrix, E. 1894.1, 1895.2,3.

ARTERIAL SYSTEM

Anatomy in various fishes. — Lota. Bonsdorff, E. J. 1853.1. — *Selachii.* Carazzi, D. 1905.1; Cavalié, M. 1903.1. — *Raja.* Hyrtl, C. J. 1857.1, 1858.1. — *Myxine.* Cole, F. J. 1905.1 (iv). — *Polyodon.* Danforth, C. H. 1912.1. — *Acipenser.* Demme, R. 1860.1. — *Lepidosteus.* Hyrtl, C. J. 1851.1.

Aorta and aortic arches

Aorta, development in — Cyclostomata. Julin, C. 1887.3. — *Acanthias.* Hoffmann, C. K. Add. 1892.1.

Ligamentum longitudinale ventrale, a ligament lying in cavity of aorta and concerned with propulsion of blood. Burne, R. H. 1909.2. — *Development of this ligament from mesenchyme in contiguity with, but independently of, the hypochord.* Franz, K. 1897.1.

Aortic arches, structure. Boas, J. E. 1880.1; Locy, W. A. 1906.1. — *Saccobranchus.* Burne, R. H. 1894.1. — *Fifth aortic arch, causes of disappearance.* Kerr, J. G. 1908.3. — *Development of aortic arches.* Legros, R. 1903.1. — *Origin, Selachii.* Rückert, J. 1888.1.

Arteries supplying particular parts or regions

Axillary or innominate arteries. *Morphology. — Accessory arterial bulbs (Nebenherzen) of axillary arteries in Chimæra.* Duvernoy, G. L. 1837.1; Valentin, G. G. 1842.2. — *Morphology of axillary arteries, Selachii.* Pitzorno, M. 1905.1.

Branchial arteries. *Morphology in — Chimæra, Heptanchus, and Raja.* Allis, E. P. 1912.1,2,3. — *Squalus.* Home, E.

1813.1. — *Teleosts.* Biétrix, E. 1894.1; ★Maurer, F. 1888.1. — *Dipnoi.* Boas, J. E. 1880.1. — *Ganoids.* Hyrtl, C. J. 1852.1. — *Cyclostomes.* Julin, C. 1887.4. — *Acipenser.* Virchow, H. 1890.3.

Special researches on the branchial arteries. — Arrangement of capillaries in gills. Quekett, J. T. 1852.1. — *Relations of efferent branchial blood-vessels to the "circulus cephalicus" in teleostean fishes.* Ridewood, W. G. 1899.2.

Carotid arteries. *Anatomy and morphology. — General account.* ★Ayers, H. 1889.1.

Carotid arteries in Elasmobranchii. — Chlamydoselachus. Allis, E. P. 1911.1; Ayers, H. 1889.1. — *Chimæra, Heptanchus, and Raja.* Allis, E. P. 1912.1,2,3. — *Head of Selachii.* Hyrtl, C. J. 1872.1. — *Acanthias.* Beauregard, H. Add. 1892.1. — *External carotid, Oxyrhina.* Trois, E. F. 1879.1.

Morphology in Polypterus, Polyodon, Amia, and Ceratodus. Allis, E. P. 1908.2, 1911.2, 1912.4, 1914.4.

Morphology of carotid arteries in various Teleostei. ★Allis, E. P. 1908.1,3, 1912.4.

Development of carotid arteries in Cyclostomes. Julin, C. 1887.3.

Coronary arteries. *Morphology in — Scyllium.* ★Carazzi, D. 1904.1,2. — *Selachii.* François-Franck, C. A. 1913.1; ★Parker, G. H. & Davis, F. K. 1899.1, 1901.1. — *Teleosts.* Lévadoux, M. 1904.1. — *Orthogoriscus.* Parker, G. H. 1900.1.

Pseudobranchial arteries. *Morphology in numerous forms in all groups.* ★Allis, E. P. 1900.3, 1908.3, 1908.1-1912.4, 1914.4. — *Vascular plexus of pseudobranchial arteries.* Müller, J. 1840.2.

Various arteries not included among the above. — Testicular arteries, Teleosts. Broussonet, P. M. 1785.3. — *Œsophageal arteries, Scyllium.* Carazzi, D. 1904.1,2. — *Splanchnic arteries, Elasmobranchii.* Diamare, V. 1909.1, 1910.1. — *Suprarenal arteries, Selachii.* Grynfeldt, E. 1902.1. — *Intestinal arteries, Ichthyopsida.* Howes, G. B. 1890.2. — *Mesenteric arteries with valves in Labridæ.* Laguesse, G. E. 1892.1. — *Subclavian arteries, Selachii.* Pitzorno, M. 1905.1. — *Abdominal arteries, origin.* Salvi, G. 1907.1, 1909.1.

VENOUS SYSTEM**Anatomy and morphology**

Miscellaneous and general. ★Hochstetter, F. 1887.1; Jacobson, L. L. 1822.1; Suchard, E. 1902.1; Nicolai, J. A. Add. 1826.1.

Anatomy in Cyclostomata. — Myxine. Klinckowström, A. 1891.1, 1895.1; Retzius, A. J. 1822.1, 1826.1. — *Petromyzon.* Robin, C. P. 1846.1.

Anatomy of venous system in Elasmobranchii. Robin, C. P. 1845.4, 1846.2,4; Lafite-Dupont, J. L. Add. 1898.1. — *Raja.* Jourdain, S. 1868.1; Parker, T. J. 1881.1.

—*Scyllium*. O'Donoghue, C. H. 1914.1.
Teleostei. —*Lota*. Bonsdorff, E. J. 1851.1, 1853.2. — *Various German teleosts*. Einstmann, J. W. 1913.1.

Homologies of veins in Dipnoi. Parker, W. N. 1889.1.

Development of venous system. ★Hochstetter, F. 1887.1, 1893.1. — *In Selachii*. Hoffmann, C. K. 1893.3; Rabl, C. 1892.1. — *Carassius*. Wintrebert, P. 1908.1.

Various venous structures, anatomy, homologies, and relationships.

Sinus urogenitalis, Petromyzon. Duvernoy, G. L. 1846.1. — *Venous blood reservoirs in Raja*. Guillot, N. 1845.1. — *Vena cava, Polypterus*. Kerr, J. G. 1910.3. — *Dilatation in ventral cavity of Raja*. Robin, C. P. 1845.1.

Discovery of muscular sphincters of veins in different organs; stomach, spiral valves and gall-bladder. Sappey, M. P. 1880.1; Mayer, P. (*Raja*) 1911.1. — *Lymphatic characters of veins in certain sharks*. Vialleton, L. 1902.1. — *Segmental veins, relation to ductus Cuvierii, Amphioxus*. Zarnik, B. 1904.2.

Veins supplying particular organs or regions

Hepatic portal veins. *Morphology and development*. ★Choronshitsky, B. 1900.1; Hyrtl, C. J. 1864.1; Rathke, M. H. 1826.1, 4; Schmid, F. C. Add. 1882.1. — *Lota*. Bonsdorff, E. J. 1851.1, 1852.1. — *Galeus and Zygæna*. Duvernoy, G. L. 1833.1, 1835.1. — *Lophius*. Jourdain, S. 1861.1. — *Myxine*. Klinckowström, A. 1890.1. — *Selachii*. ★Neuville, H. 1896.1, 1900.2, 1901.1.

Renal veins. Martino, A. 1845.1; Nicolai, J. A. Add. 1826.1.

Renal portal veins, origin, structure, etc. — *Lota*. Bonsdorff, E. J. 1853.3. — *General treatise*. ★Jourdain, S. 1859.1. — *Origin and significance*. Woodland, W. N. 1906.2.

Structure and development of various unclassified veins. — *Spermatic veins*. Broussonet, P. M. 1785.3. — *Veins supplying head*. Grosser, O. 1907.1. — *Lateral vein in skate*. Rand, H. W. & Ulrich, J. L. 1905.1. — *Veins of air-bladder*. Reinhardt, J. C. 1822.1. — *Veins of brain, Elasmobranchs*. Rex, H. 1891.1.

LYMPHATIC VASCULAR SYSTEM

Anatomy and morphology

Miscellaneous and general. Fohmann, V. 1827.1, 2; Hewson, W. 1770.1; Jacobson, L. L. 1825.1; Možeyko, B. 1913.4; ★Sappey, M. P. 1880.1, 2. — *Controversy concerning discovery*. Hewson, W. Add. 1769.1, 1771.1.

Anatomy of lymphatics in Elasmobranchii. — *Raja*. Jourdain, S. 1868.1. — *Plagiostomia*. Robin, C. P. 1867.1. — *Torpedo*. ★Vialleton, L. 1902.2.

In various fishes, chiefly Teleosts. Hyrtl, C. J. 1843.1; Jossifov, M. S. 1905.1, 1906.1; Trois, E. F. 1867.3, 1878.1, 2. — *Amia*. Hopkins, G. S. 1893.1. — *Lopho-*

branchii. Huot, A. 1897.1. — *Gadus*. Jourdain, S. 1867.1. — *Gadidae and Pleuronectidae*. Trois, E. F. 1878.1. — *Muraena*. Jourdain, S. 1868.2. — *Lophius*. Trois, E. F. 1876.4, 1878.1. — *Uranoscopus*. Trois, E. F. 1878.1, 1880.4. — *Amiurus*. Kilborne, F. L. Add. 1885.1.

Development of the lymphatic system. Favaro, G. 1908.2; Lankester, E. R. 1873.3. — *Bdellostoma (tail region)*. Allen, W. F. 1913.1. — *Trout*. ★McClure, C. F. 1913.1–1915.2, 1915.1.

Special parts of lymphatic system

Lateral lymph vessels. Hyrtl, C. J. 1843.1; Robin, C. P. 1845.3, 5.

Lymph sinuses, structure and function. — *Peribranchial lymph spaces in Petromyzon*. Ewart, J. C. 1878.1. — *Cephalic sinus*. Hyrtl, C. J. 1843.1. — *Saccus paravertebralis, Teleosts*. Nusbaum, J. 1903.3.

Lymphatics in the head, tail, fins, etc., of Lepidosteus, Polyodon, and Scorpænichthys. ★Allen, W. F. 1906.1–1913.1.

"Caudal heart," or caudal sinus, a pulsating lymph sac in the tail, propelling lymph into the caudal veins.

For general considerations of the caudal heart, see ★Favaro, G. 1905.2–1906.1.

Caudal heart of Cyclostomata. — *Bdellostoma*. Greene, C. W. 1900.1, 1902.1. — *Myxine*. Retzius, M. G. 1890.1.

Caudal heart of Anguilla, structure, functions, etc. Hyrtl, C. J. 1843.1; ★Jones, T. W. 1869.1; Robin, C. P. 1880.1. — *Causes of movement*. Eckhard, C. 1863.1. — *Discovery*. Hall, M. 1831.1, 1832.1. — *Regulation through spinal cord*. Polimanti, O. 1912.3. — *Electrogram of pulsations*. ★Trigt, H. 1913.1. — *Alleged first notice*. Leeuwenhoek, A. Pre-Linn. 1696.1, 1697.1.

Lymphoid tissue. Called also "adenoid tissue" and represented by local masses or organs in various parts of the body. The "lymphatic glands" of higher vertebrates are lacking in fishes.

Histology of lymphoid tissue. Ciaccio, C. 1909.1; ★Drzewina, A. 1905.1.

Lymphoid "glands" or organs — *In æsophagus of Selachii (Torpedo especially)*. Drzewina, A. 1904.3, 1909.1, 1910.2; Kulchitzki, N. 1911.1. — *In heart of Acipenser*. Hertwig, C. W. 1873.1; Schultze, M. J. 1872.1. — *Heart of Mola*. Trois, E. F. & Perugia, A. 1867.1. — *Kidney, Polyodon*. Downey, H. 1909.1.

Lymphatics of the intestine. Davidoff, M. 1886.1. — *Torpedo*. Diamare, V. 1913.1; Vialleton, L. 1902.2. — *Teleosts*. Langer, C. 1870.1. — *Lota*. Melnikov, N. 1866.1, 1867.1. — *Elasmobranchii*. Pilliet, A. H. 1890.1. — *Development*. Stöhr, P. A. 1897.1.

Lymphatics of the nervous system. — *Lymphoid structure above brain of Lepidosteus*. Chandler, A. C. 1911.1. — *In spinal meninges*. Sterzi, G. 1901.1. — *Central nervous system Selachii*. ★Sterzi, G. 1907.1.

Circulatory Syst. — Cont'd.**PHYSIOLOGY****Circulation of blood and lymph**

Miscellaneous and general papers. ★Brünings, W. 1899.1; Gruetzner, P. F. 1897.1, 1899.1, 1901.1, 1904.1; Le Sauvage, E. 1821.1; ★Schoenlein, K. 1895.1; Schoenlein, K. & Willem, V. 1895.1, 2. — *Early refs.* Duverney, J. Pre-Linn. 1729.1; Leeuwenhoek, A. Pre-Linn. 1695.1–1709.2.

Special researches in the physiology of the circulation. — *Distribution of blood in gills, sharks and teleosts.* Biétrix, E. 1894.1; Döllinger, I. 1837.1. — *Caudal circulation in various fishes.* Favaro, G. 1905.5. — *Hypobranchial circulation in Elasmobranchs.* Ferguson, J. S. 1911.1. — *Systemic, portal, and caudal heart circulation in Bdellostoma.* Greene, C. W. 1900.1, 1902.1.

Circulation in capillary vessels. Hall, M. 1831.1. — *Circulation in suprarenals.* Srdinko, O. V. 1905.1.

Lymph circulation in Pleuronectes. Jourdain, S. 1880.2; Pouchet, G. 1881.1.

Blood pressure. — *In heart.* Biétrix, E. 1894.2. — *Relation to functional activity.* Greene, C. W. 1905.1. — *Effects of intravenous salt solutions on blood pressure in Skate.* Hyde, I. H. 1908.1, 1909.1. — *Blood pressure in branchial artery.* Jolyet, F. 1872.1.

COLLECTION, PRESERVATION, AND EXHIBITION OF FISHES

For ways of securing specimens, of which many are applicable to the collector's needs, see *Fishing methods*.

For preservation of fishes for use as food, see *Preservation, under Fisheries*.

For a related topic, see *Technique and methods of scientific investigation*.

Museum curators in many parts of the world have issued circulars or leaflets containing instructions on the best methods of securing and preserving fishes as scientific specimens.

For the latest and most comprehensive work, see "★*Handbook of instructions for collectors*," issued by the British Museum (Natural History) London, 4th ed. 1921.

Directions and instructions for the collection and preservation of fishes.

Text in English. Agassiz, J. L. 1853.2; Bean, T. H. 1881.3; Günther, A. C. 1875.1; Jordan, D. S. 1902.6; Sinel, J. 1906.2; Anon. 291; Sclater, P. L. Add. 1862.1.

Text in French. Pellegrin, J. 1907.3, 1908.2; Turgot, E. F. 1758.1.

Text in German. Frenzel, F. 1892.1; Günther, A. C. 1875.2; Surbeck, G. 1910.6.

Text in various languages. — *Russian.* Berg, L. S. & Kouznetzoff, I. D. 1908.1. — *Spanish.* Delfin, F. T. 1900.1. — *Portuguese.* Goeldi, E. A. 1896.2. — *Japanese.* Tsuchida, T. Add. 1914.1.

Methods of collecting in South America. Haseman, J. D. & Eigenmann, C. H. 1911.1.

Appearance of color in alcoholic fishes. Bliss, R. 1872.1, 3; Cope, E. D. 1872.18.

Medium for preserving colours. Haly, A. Add. 1892.1; Guyot, — & Pajot, — Pre-Linn. 1749.1.

Miscellaneous papers, chiefly concerning preservation. Bonnet, C. 1774.1; Collins, J. W. 1881.1; Hemmen, — 1777.1; Innes, W. T. 1912.1; Leonhardt, E. E. 1905.20, 1908.3; Malm, A. H. 1882.1; Reifschneider, O. 1909.1; Ricord, A. 1827.1; Rusticus in Urbe 1829.1; Anon. 453, 456; Réaumur, R. A. Pre-Linn. 1750.1. — *Importance of killing freshly-captured fish.* Baird, S. F. 1871.23. — *Recognition of fishes caught by use of chlorine.* Rusconi, A. 1910.1.

Exhibition of fishes. *Museum exhibition, chiefly outlines and plans for educational exhibits.* Gray, J. E. 1841.1; Holder, C. F. 1908.5; ★Lucas, F. A. 1910.1; Meek, S. E. 1902.1; ★Miner, R. W. 1910.1.

For exhibits of fishes in particular institutions, see under *Museums*; for displays with especial reference to fisheries, see *Exhibitions under Fisheries*.

Taxidermy. *Methods in the mounting of fishes.* ★Figgins, J. D. 1910.1; Fox, Charles, 1839.1; ★Franklin, D. 1908.1; Shufeldt, R. W. 1894.3; Walker, C. A. 1870.1; Swainson, W. Add. 1840.1, 1870.1. — *Denton Brothers' method.* Bean, B. A. 1892.6. — *Davidson's method.* Davidson, H. E. 1885.1.

Metalloplastic process for the exhibition of fishes. Mattes, M. R. 1883.1.

How to make and color casts. Taylor, J. E. 1878.1.

Dried preparations. Dubois, R. Add. 1914.1; Gronovius, J. Pre-Linn. 1742.1.

COLORATION

For Color perception in fishes, see under *Behavior*.

For nature of the silvery substance of the fish skin, see *Argenteum under Integument*.

Coloration of various fishes. *Special papers dealing with the coloration of —* *Haplochilus.* Arnold, J. P. 1911.12; Gerlach, G. 1912.1. — *Bermuda fishes.* Bristol, C. L. 1903.2. — *Platypæcilus maculatus.* Finck, M. C. 1911.8. — *Florida fishes.* Fowler, H. W. 1903.1. — *Pæcilia limantouri.* Fowler, H. W. 1903.5. — *Electrical fishes.* Fritsch, G. T. 1901.1. — *Gibbonsia.* Holder, C. F. 1899.2. — *Phoxinus laevis.* Leydig, F. 1892.1. — *Marine fishes.* McIntosh, W. C. 1901.1. — *Variations in Etheostoma caprodes.* Moenkhaus, W. J. 1893.1–1894.1. — *Deep-sea fishes.* Nutting, C. C. 1899.1. — *Cremnobates and Pomacentrus.* Smith, R. 1883.2, 4. — *The apon.* Weber, M. C. 1907.1. — *Xiphophorus rachovii.* Weinhausen, H. 1911.1. — *Fistularia tabacaria.* Wright, T. S. 1863.1.

Coloration of various young fishes. — *Cyprinidæ.* Agassiz, J. L. 1848.2. —

Leuciscus. Ayres, W. O. 1848.1, 1849.3.
—*Labrus* (coloration of pelvic fins).
McIntosh, W. C. 1887.1. — *Gadus*.
McIntosh, W. C. 1910.1. — *Pomacanthus*. Nichols, J. T. 1915.4.

Chromatophores. *Histological structure and arrangement, relation to other epidermal cells, circulatory system, etc.* Franz, V. 1908.2; Garstang, W. 1895.1; Nègre, L. 1906.1; Pouchet, G. 1875.1; Rabl, H. 1897.1; Zimmermann, K. W. 1893.1; Golovin, E. Add. 1907.1; Lehmann, A. Add. 1906.1; Solger, B. F. Add. 1890.1. — *Pigment cells of intestine*. Oppel, A. 1889.1. — *Division in peritoneum*. Roques, E. G. 1904.1.

Origin and development of color-cells. ★Asvadourova, N. 1913.1; Bolk, L. 1908.1-1910.1; Borcéa, J. 1909.3; Cavalié, M. 1904.1; Eigenmann, C. H. 1891.3, Add. 1889.1; Eigenmann & Eigenmann 1889.6; Ryder, J. A. 1886.10; ★Stockard, C. R. 1915.1,2; Wagner, K. 1911.1.

For the mechanism of contraction and expansion producing changes in coloration, see below.

Influence of food, light, and temperature. — *Food*. Knauthe, K. 1894.1. — *Effects of starvation*. Sécerov, S. 1909.1, 1910.1, 1912.1 — 1914.1.

*Red variant of *Perca fluviatilis*, coloration due to crustaceorubin from food.* Mäklin, F. W. 1864.1; Mela, A. J. 1881.1, 1902.1; Palmén, J. A. 1886.1; Schneider, G. 1908.3; Sjöstedt, G. 1894.1; Suomalainen, F. W. 1908.2.

Light, influence on coloration. Murisier, P. 1912.1; Regnard, P. 1893.1; Steinach, E. Add. 1891.1. — *Reflection from mirror produces pigmentation of colorless, ventral side of flounder.* ★Cunningham, J. T. 1891.3, 1893.10, 1895.1; Cunningham & MacMunn, 1893.1. — *Influence on pigmentation of *Crenilabrus*.* ★Gamble, F. W. Add. 1909.1, 1910.1. — *Effect of darkness on goldfish.* Ogneff, J. F. 1908.1, 1910.1, 1911.1; Viré, A. 1904.1.

Temperature, influence. Frisch, K. 1911.3. — *Warmth.* Murisier, P. 1912.1. — *Cold.* Polimanti, O. 1912.2.

Nuptial coloration. *General.* Barrett-Hamilton, G. 1902.1; Hess, C. 1913.1; Kornhuber, G. A. 1900.1. — *Coregonus*. Bean, B. A. 1895.2. — *Of *Anguilla*.* Petersen, C. G. 1895.4, 1896.1.

See also Breeding Habits, and Spawning Habits, under Reproduction. See also under Sexual dimorphism.

Pigments, nature or chemical composition. ★Ballowitz, E. 1912.1-1914.1; ★Cunningham, J. T. & MacMunn, C. 1893.1; Krukenberg, C. F. 1882.1.

Blue coloring matter, nature. Leydig, F. 1885.1; Pouchet, G. 1872.1,7, 1873.1. — *In *Duymaeria*.* Hilgendorf, F. M. 1879.1. — *In fins of *Crenilabrus pavo*.* Zeynack, R. 1901.1, 1912.1,2.

*Blue-green pigment of *Odax*, composition.* Francis, G. Add. 1875.1. — *Green pig-*

*ment of *Belone*.* Krukenberg, C. F. Add. 1882.2.

Protective coloration and mimicry. *Miscellaneous papers on protective coloration.* Lagally, M. 1903.1; Laloy, L. 1907.1; Prince, E. E. 1892.1; Smith, W. A. 1893.1. — *Popular acc't.* Ward, F. 1908.2. — *Reflection as a concealing and revealing factor.* Ward, F. 1913.1.

Brilliant (non-concealing) coloration of coral-reef fishes considered an "immunity" coloration, all "warning" coloration considered likewise. ★Reighard, J. E. 1908.1; Longley, W. H. Add. 1913.1, 1914.1.

Mimicry in fishes. Bézier, T. 1902.1; Bouvier, E. L. 1888.1; Dunn, M. 1896.1; Moenkhaus, W. J. 1895.2; Anon. 360. — *Possible mimicry of poison-spined weever fish (*Trachinus*) by the common sole (*Solea*).* Masterman, A. T. 1908.2. — **Ophichthys colubrinus* mimicking the snake, *Platurus colubrinus*.* Schnee, S. 1905.1.

*Mimicry of a leaf by *Monocirrhus polyacanthus*.* Milewski, A. 1914.2,8.

For further data on this fish, see C. H. Eigenmann & W. R. Allen, "A leaf mimicking fish." Biol. Bull. 1921, vol. 41, pp. 301-305. 3 figs.

*Mimicry of dead oak-leaf by *Platax vespertilio*.* Willey, A. 1904.2.

*Mimicry of environment in *Pterophryne*.* Ives, J. E. Add. 1899.1.

Miscellanea. *Notes, remarks and minor papers on coloration.* Aflalo, F. G. 1903.1; Bean, B. A. & Weed, A. C. 1911.2; Bliss, R. 1872.3; Camerano, L. 1885.1; Eigenmann, C. H. 1890.2; Fowler, H. W. 1912.4; Garman, S. 1877.3; Goode, G. B. 1890.1, Add. 1889.1; Heincke, F. 1875.1; Jäger, Gustav 1868.1, 1908.2; Jordan, D. S. 1902.1; Kapelikin, V. 1904.1; Leonhardt, E. E. 1904.9; Lönnberg, A. J. 1902.4, 1903.3; Nichols, J. T. 1916.7; Putnam, F. W. 1859.1; Smith, W. A. 1897.1; Wied-Neuwied, M. A. 1853.1; Adams, A. Add. 1848.1; Cuénot, L. Add. 1892.1.

*Relation to vertical distribution in *Cyclogasteridæ*.* Burke, C. V. 1911.1. — *Unilateral coloration with a bilateral effect, in *Leptocephali*.* Eigenmann, C. & Kennedy, C. 1901.1. — *Selection and coloration.* Popoff, M. 1906.1. — *The markings of fish with relation to their ancestral origin.* Kent, W. S. Add. 1892.1.

Biological significance of silvery coloration or lustre. Abonyi, S. 1908.1; Franz, V. 1907.2; Kapelikin, V. 1905.1; Murisier, P. 1915.1; Schnee, S. 1908.1; ★Hess, C. Add. 1914.1.

ABNORMALITIES IN COLORATION

Albinism or lack of pigmentation. *Miscellaneous.* Bézier, T. 1902.1; Goode, G. B. 1875.1,2; Schreitmüller, W. 1911.12; Seabra, A. F. 1909.1.

*Records of occurrence of albinism or partial albinism in — *Tinca vulgaris* (partial).* Bellotti, C. 1906.1. — **Rhombus*.* Boeke, J. 1904.1. — **Acipenser*.* Brandt, J. F. 1850.1; Brunn, M. 1901.1. — **Pleuro-**

Coloration — Cont'd.

nectes platessa. Cunningham, J. T. (*piebald spm.*) 1893.1; Gadeau de Kerville, H. 1895.1; Schleep, B. C. 1829.2. — *Myxine* (partial). Dean, B. 1903.2. — *Brook-trout*. Freeburg, B. 1878.1; Pettis, C. R. 1903.1. — *Merluccius*. Garstang, W. 1900.1. — *Anguilla*. Knox, F. J. 1871.1; Raettig, A. 1879.1; Seligo, A. 1901.2. — *Solea*. Lagatu, H. 1887.1; Sacchi, M. 1899.1,2. — *Clarias anguillaris*. Panceri, P. 1873.1. — *Micropterus*. Shufeldt, R. W. 1902.14. — *Salmo fario*. Surbeck, G. 1904.1. — *Raja*. Traquair, R. H. 1893.8. — *Silurus*. Zur Mühlen, M. 1911.24.

Ambicoloration or unicoloration in flat-fishes, see under *Pleuronectidae*.

Melanism or development of black pigmentation. ★Klunzinger, C. B. 1903.2, 1907.1; Knauthe, K. 1892.1. — *Barbus*. Annandale, N. 1907.2. — *Cyprinodon*. Arnold, J. P. 1912.30. — *Phoxinus laevis*. Fatio, V. 1875.1,2. — *Platygllossus*. Günther, A. 1871.1. — *Cyprinidae*. Siebold, C. T. 1861.2.

Metachromatism or abnormal color variants, suggesting albinism, xanthochroism, etc. — *Polychromism in Myxine*. Dean, B. 1903.2. — *In various Italian fishes*. Ninni, E. 1903.3 (*Pleuronectes*), 1907.2, 1908.1; Trois, E. F. 1909.2, (*Lophius*) 1909.3. — *Anguilla*. Ninni, E. 1912.2; Pavesi, P. 1894.1; Trois, E. F. 1905.2, 1908.3.

Xanthochroism, or appearance of yellow pigmentation. Schreitmüller, W. 1911.12. — *Anguilla*. Bolau, C. C. 1881.2; Kershaw, J. A. 1904.1. — *Petromyzon*. Festa, E. 1900.1. — *Nemachilus*. Fischer, J. 1874.1. — *Phoxinus*. Riedel, K. 1911.1.

CHANGES IN COLORATION

Adaptive coloration or slight temporary modifications in coloration to fit the environment. Agassiz, A. 1892.1; Franz, V. 1910.2; La Blanchère, P. R. 1872.4; Noé, J. & Dissard, A. 1894.1; Schenk, H. 1914.1.

Observations on color changes in various fishes. Heincke, F. 1875.1; Schreitmüller, W. 1914.7; Semper, C. Add. 1895.1. — *Salmo fario*. Crisp, E. 1864.1; Schöndorff, A. 1903.1. — *Cottus bubalis*. Cunningham, J. T. 1889.2. — *Gasterosteus*. Dallas, J. 1895.1. — *Capros aper*. Day, F. 1880.9. — *Labrus maculatus*. Holt, E. W. & Byrne, L. W. 1897.2. — *Lebias*. Schenk, H. 1914.1. — *Echeneis*. Schnee, S. 1902.1; Vaillant, L. L. Add. 1884.1.

Miscellaneous papers on changes in coloration. Chamberlain, W. B. 1867.1; H., T. W. 1876.1; Harting, P. 1868.3, 1871.3; Hermann, L. 1896.1; Kent, W. S. 1873.3; M., A. R. 1871.1; Regan, C. T. 1909.9; Schenkling-Prévôt, — 1894.1; ★Townsend, C. H. 1908.1, 1910.1; Anon. 131, 203, 204.

Experimentally induced changes. Pouchet, G. 1871.2, 1872.7, 1873.1. — *Importance of physical stimulus.* Rynberk,

G. A. 1911.1,2. — *Slow changes through confinement in vessels of different colors.* Stark, James 1830.1. — *Nocturnal and diurnal changes.* Verrill, A. E. 1897.1. — *Seasonal changes.* Wheatland, R. H. 1862.1.

Influence of vision (including color perception) in color changes. (Watson considers such adaptation to background as an instinctive response, controlled entirely by the sympathetic system and without reference to color perception.)

Adaptation in coloration of flat-fishes (Pleuronectidae) to various backgrounds, and influence of vision in these changes. Bordage, E. 1911.1; Loeb, J. 1912.1; Mast, S. O. 1915.1,2, Add. 1913.1; Polimanti, O. 1912.1; ★Sumner, F. B. 1910.1–1911.2; Steinach, E. Add. 1891.1. — *Coloration of flounders after extirpation of eyes.* Buijtendijk, F. J. 1911.1; Lubach, D. 1864.2.

Popular review of Sumner. Montanus, E. 1912.1.

For a most valuable contribution with colored plates on color changes in the flounders, see ★Mast, S. O. in Bull. U. S. Bureau Fisheries, 1914 (1916), vol. xxxiv, pp. 173–238, 19 pls.

Unilateral change, produced by excision of one eye. Pouchet, G. 1877.1,2; 1879.1. — *Discussion of this work.* Giard, A. 1877.1. — *Visual influence.* Fiore, G. 1906.1.

Lack of color adaptation in blinded fishes. Mayerhofer, F. 1909.1; Pouchet, G. 1876.1; Sumner, F. B. 1911.2.

For other instances of color vision, involving only slight color changes, see Color perception under Behavior.

Mechanism of color changes through contraction and expansion of chromatophores. Ballowitz, E. 1912.1–1914.1, Add. 1914.1–.3; Lode, A. 1891.1; Nardo, G. D. 1844.3; Pfeffer, G. J. 1910.1; Provazek, F. 1900.2; ★Spaeth, R. A. 1913.1–1914.1; Vescovi, P. 1886.1; Zimmermann, — 1893.1; Fuchs, R. F. Add. 1914.1; ★Rynberk, G. A. Add. 1906.1.

Innervation of chromatophores, relation to central nervous system, etc. Bauer, V. 1910.2; Eberth, C. J. & Bunge, R. 1895.1; Frisch, K. 1910.1; ★Pouchet, G. 1871.1, 1872.3, 1876.1; Rynberk, G. A. 1906.2, 1907.1, 1908.1; Ballowitz, E. Add. 1893.1, 1894.1. — *Effects of section of nervus sympathicus.* Sécerov, S. 1913.1.

COMMENSALISM AND SYMBIOSIS

For a related topic, see Parasitic fishes. See also Parasites of fishes.

Popular general works, including fishes. Beneden, P. J. Add. 1876.1; Step, E. Add. 1914.1.

Miscellanea, popular accounts, etc. Beneden, P. J. 1869.1, 1871.1; Christopher, H. 1905.1; Coupin, H. 1899.1; Cuénot, L. 1892.1; Grieg, J. A. 1896.3. — *Barnacle on gar pike.* Ryder, J. A. 1879.2. — *Mullet encased in Pyrosoma, an Ascidian.* Giglioli, E. H. Add. 1886.1.

Algæ and fishes. *Green algæ growing on fishes.* Link, E. 1911.1; Minakata, K. 1908.1.

For plants destructive to fishes such as the bladderwort, see Noxious organisms under Pisciculture. For Fungus growths, see Diseases of the gills and skin under Pathology.

Coelenterates and fishes. *Hydroids and fishes.* Franz, V. & Stechow, E. 1908.1; Heath, H. 1910.1; Lloyd, R. E. 1907.2, 4. — *Minous inermis and hydroid, Stylactis.* Alcock, A. W. 1892.1, 1899.4. — *Dogfish with Sertularia on dorsal spine.* Cornish, T. 1868.5. — *Hippocampus covered with Serialia.* Newman, E. 1873.2.

Fishes associated with medusæ. Alcock, A. W. 1901.1; Gadeau de Kerville, H. 1894.1; Gill, T. N. 1877.5; Oesterbol, A. 1885.1, 2; Peach, C. W. 1855.1; Scheuring, L. 1915.1; Collingwood, C. Add. 1867.1, 1868.1. — *Caranx and medusæ.* Lunel, G. 1883.1; Pellegrin, J. 1905.3; Anon. 64; Giard, A. Add. 1887.1. — *Trachurus and medusæ.* Macleay, W. J. Add. 1884.2.

Fishes (Premnas and Amphiprion) living in sea anemones. Collingwood, C. 1868.1; Crespigny, C. C. 1869.1; Horst, R. 1901.1; Sluiter, C. P. Add. 1888.1.

Nomeus commensal with the Portuguese Man-of-war (Physalia). Wallich, G. C. Add. 1863.1, 1869.1.

Echinoderms and fishes. *Syngnathus intestinalis living inside Holothurians.* Ramsay, E. P. 1881.1. — *Fish (not named) commensal with an echinus.* Sarasin, C. F. Add. 1886.1.

Fierasfer symbiotic with echinoderms, pearl oysters, and tunicates.

Fierasfer living in Holothurians. Alcock, A. W. 1901.1; Anderson, A. J. 1859.1; Bosset, C. P. 1839.1; ★Emery, C. 1880.1, 2; Grieg, J. A. 1896.3; Holder, C. F. 1881.1; Holder, J. B. 1871.1; ★Linton, E. 1907.1; Waite, E. R. 1897.1; Semper, C. Add. 1868.1.

Living in starfishes. Bleeker, P. 1854.17, 19, 1858.14; Doleschall, C. L. 1858.1–1861.2.

Symbiosis with pearl oysters. Günther, A. 1886.1; Parville, H. 1899.1; Putnam, F. W. 1874.4; Saint-Amans, J. F. 1778.1; Southwell, T. 1910.3; Stearns, R. E. Add. 1887.1.

Living within tunicates. Weber, M. 1905.1.

Mollusks and fishes. *Apogonichthys strombi (a fish) living in the mantle cavity of Strombus gigas.* Plate, L. H. 1908.1.

Occasionally fishes (Fierasfer and Oligocottus) have been found, imbedded or covered over by the mother-of-pearl layer, in valves of the pearl-oyster. See Günther, A. 1886.1; and Stearns, R. E. Add. 1887.1.

The following citations indicate that occasionally fishes (Batrachus and Ophidium) may be found in oysters. * Dekay, J. E. 1842.2; Heyke, D. Pre-Linn. 1744.1.

For incubation (of Bitterling, Rhodeus)

in gill-cavities of mussels, see Parental care under Reproduction.

For implantation and parasitism of the Glochidia of fresh-water mussels (Unionidæ) on fishes, see Mollusca under Parasites.

Sponge and fish. *Garmannia spongicola n. sp. from off North Carolina, a goby inhabiting the cavities of large cuplike sponges.* Radcliffe, L. 1917.1.

Symbiosis among fishes

The pilot fish (Naucrates ductor) accompanying sharks. Beneden, P. J. 1870.1; Geoffroy-Saint-Hilaire, E. 1802.7, 1807.2; Holder, C. F. 1900.2; Moseley, H. N. 1879.1; Penny, C. F. 1873.1; Winkler, — 1802.1; Anon. 362.

Seriola zonata accompanying sharks. Holder, C. F. 1900.2.

The sucking fishes, Echeneis and Remora, symbiotic with sharks. Baird, S. F. 1876.16; Beneden, P. J. 1870.1; Burnell, A. H. 1876.1; Castillo, L. 1912.11; Cornish, T. 1870.3; Geare, R. I. 1902.1; Holder, C. F. 1900.2, 1905.2; Moseley, H. N. 1879.1; Anon. 362.

Echeneis symbiotic with — Sphyræna barracuda. Lütken, C. F. 1874.1 (v). — *Balistidæ.* Murphy, R. C. 1914.1.

For a discussion of the habit of the sucking fishes of entering the gill cavities or mouths of their hosts, with a résumé of all known accounts, see E. W. Gudger in Natural History, 1922, vol. 22, pp. 243–249.

DEEP-SEA FISHES

Under this term are included the fishes adapted to conditions of extreme cold and utter darkness living between the 100-fathoms line or the boundary of the continental shelf, often taken as an arbitrary upper limit, and the abyssal depths of nearly $3\frac{3}{4}$ miles.

The latter, the greatest from which a deep-sea fish has been dredged, is the profound depth of 6,035 meters, (19,800 ft.) where, off the Cape Verde Islands, a Brotulid, *Grimaldichthys profundissimus* Roule (1913.5, Add. 1914.2) was taken by the Prince of Monaco.

A table including the recorded depths for all (earlier) species will be found in Brauer, A. 1908.1, pp. 365–410.

Macrias amissus from off southern Chili, largest deep-sea fish recorded to 1900, was about five feet in length. Gill, T. N. & Townsend, C. H. 1901.1.

Apparatus used in deep-sea investigations. Regnard, P. 1893.4; ★Tanner, Z. L. 1885.1–1889.1; Add. 1897.1; Townsend, C. H. 1902.1, Add. 1896.1; Albert I, H. C. Add. 1891.1; Hoyle, W. E. Add. 1889.1.

Existence of a pelagic element in the bassalian fauna. Chun, C. 1887.1, 1888.1, 1890.1.

“Tenanting of the deep sea with fishes has been a gradual process, beginning at latest in early Cretaceous times and gradually proceeding until the present day.” Woodward, A. S. 1898.1.

Miscellaneous items, popular accounts, etc., on deep-sea fishes. Agassiz, A. 1888.1; Carpenter, W. L. 1870.1; Christison, S.

Deep-sea Fishes — Cont'd.

1905.1; Delaroche, F. E. 1809.3; Evermann, B. W. 1902.24; Goode, G. B. 1889.1; Hussakof, L. 1915.2; Jordan, D. S. 1908.1; Malmgren, A. J. 1870.2; Martens, J. B. 1883.1; Vaillant, L. L. 1886.1, 1887.1; Wade, H. T. 1910.1; Anon. 228, 393; Gill, T. N. Add. 1884.1; Hunt, A. R. Add. 1888.1.

General popular treatises

The following citations are general popular scientific works on the conditions affecting life in the depths of the ocean, including some matter on fishes. Many of these authors have been leaders in deep-sea and general oceanographical investigations.

Text in English. Bullen, F. T. 1901.1–1904.2; Hickson, S. J. 1893.1; ★Johnstone, J. 1908.1, 1911.2; ★Murray, J. & Hjort, J. 1912.1; ★Thomson, C. W. 1873.1, 1877.1; Wallich, G. C. 1862.1.

Text in French. Dollo, L. 1885.1, Add. 1891.1; ★Filhol, H. 1884.1, 1885.1.

Text in German. ★Chun, C. 1900.1, 1903.1; Marshall, W. A. 1888.1; Seelinger, O. 1901.1.

The following are smaller papers on the environmental conditions prevailing in the oceanic depths. Mangoldt, E. 1912.1; Nutting, C. C. 1901.1; Reed, T. S. 1904.1; Roule, L. 1912.6; Walther, J. K. 1904.1.

General systematic treatises

For a recent valuable systematic monograph with colored plates of many characteristic species and a full bibliography, based primarily on the collections of the "Valdivia" of the German Deep-Sea Expedition, see ★Brauer, A. 1908.1.

For a general résumé, with descriptions and figures of all forms known up to 1896, based chiefly on the collections of the "Albatross," see ★Goode, G. B. & Bean, T. H. 1896.1.

Large collections were obtained which have been made the subjects of extensive monographs, in the reports of the following oceanographic expeditions. — "Investigator," Indian Ocean. Alcock, A. W. 1899.1. — "Challenger." ★Günther, A. 1887.5. — "Travailleur et Talisman." ★Vaillant, L. 1888.2.

The collections of the Prince of Monaco, made principally in the North Atlantic and the Mediterranean on the campaigns of his yachts, "Hirondelle" and the "Princesse Alice," have been described by Albert I, H. C. 1887.1–1906.1; Collett, R. 1889.1, 1890.1, 1896.2; Richard, J. 1905.1; Roule, L. 1913.5, 1914.1, 6; ★Zugmayer, E. 1911.1, 1911.2, 1913.2, 1914.1.

List of known species of deep-sea fishes, with distribution. Garman, S. 1899.1.

Coloration of deep-sea fishes

The significance of coloration in deep-sea fishes is intimately bound up with the question of the depth of the penetration of sunlight. Many authors, especially Nutting, believe that

light in the greater depths is furnished by the phosphorescent organisms.

Dr. J. Hjort of the "Michael Sars" expedition (Hjort, J. 1911.1), found that at 500 meters red rays are absent and blue and violet rays present; at 1,000 m. ultra-violet rays are perceptible; and at 1,700 m. there is no trace of light. He suggested that the 500 meter line marks the border between two differently colored faunas; iridescent and silvery fishes occur in the upper zone, black and red fishes in the lower. At and beyond such depths these colors would tend to render the fishes invisible.

For further discussion of the coloration of deep-sea fishes, see Burke, C. V. 1911.1; Nutting, C. C. 1899.1, 1901.1.

Sense organs of deep-sea fishes

For the anatomy of the phosphorescent organs, see under Luminosity and phosphorescence.

For the most comprehensive treatment of the anatomy of the eye and the phosphorescent organs of deep-sea fishes, see ★Brauer, A. 1908.2.

Structure of the eyes, both normal and the protruding telescopic eyes of some forms. Brauer, A. 1902.2, 3, 1904.1; Caullery, M. 1905.1; Franz, V. 1907.1; Frisch, K. 1909.1; Lendenfeld, R. 1885.1; Zugmayer, E. 1910.2.

Possibility of vision in the deep sea. Chun, C. 1893.1.

Anatomy of the — brain. ★Trojan, E. 1906.1 — of the ear. ★Bierbaum, G. Add. 1914.1.

DEEP-SEA FAUNA**With a geographical arrangement**

Antarctic Ocean. ★Dollo, L. 1900.1–1900.4, 1904.1, 1906.2, 3, 1907.1, 1908.1, 1909.1, 3; ★Pappenheim, P. 1914.1.

Arctic Ocean. Jensen, A. S. 1905.1; Jordan, D. S. & Clark, G. A. 1906.1; Lütken, C. F. 1880.1, 4. — *Bering Sea.* Gilbert, C. H. 1895.1.

Indian Ocean. ★Alcock, A. W. 1889.3–1902.1; Alcock, A. W. & McGilchrist, A. C. 1892.1; Boulenger, G. A. 1901.17; ★Lloyd, R. E. 1909.1.

North Atlantic Ocean

Various localities, especially deep waters off the European countries. Bean, B. A. 1898.2; Bean, B. A. & Weed, A. C. 1909.1, 2; Beechey, F. W. 1842.1; Collett, R. 1904.1; ★Goode, G. B. & Bean, T. H. 1878.2, 4, 5, 1881.2, 1882.3, 1885.2, 3, 1894.1, 2, 3; Günther, A. C. 1874.4, 1888.2, 1889.1, 2, 3; ★Hjort, J. 1901.4, 1911.1, 2; Holt, E. W. & Byrne, L. W. 1908.1; Jungersen, H. F. 1898.1, 1899.1, 1905.1; Lea, E. 1913.2; Poppe, S. A. 1903.1.

Deep water off Portugal. Girard, A. A. 1893.2, 1895.1; Lütken, C. F. 1894.1; Neuville, H. 1897.2; Osorio, B. 1906.2, 1909.1, 1911.1; Wright, E. P. 1868.1.

Mediterranean Sea. Ariola, V. 1904.1, 1912.1; Giglioli, E. H. 1884.1, 1893.1; ★Lo Bianco, S. 1901.1, 1903.1, 1904.1; Marion, A. F. 1883.2; Palacky, J. 1887.1; ★Zugmayer, E. 1911.2.

Pacific Ocean

Off Japan. Jordan, D. S. 1898.2; Jordan, D. S. & Snyder, J. O. 1903.1; ★Jordan, D. S. & Starks, E. C. 1904.1 (*List*); Tanaka, S. 1910.1.

Southern Pacific. Gilbert, C. H. 1908.1, 1911.1. — *Hawaiian Is.* ★Gilbert, C. H. 1905.1. — *Off Tasmania.* McCulloch, A. R. 1907.1. — *Off New Zealand.* Hamilton, A. Add. 1896.1.

DENTITION (OF FISHES)

Comprising the development, histology, and morphology of the teeth of fishes.

For related subjects, see *Integument, and Dermal Skeleton.*

General treatises

Works of a general nature, chiefly comparative odontologies or manuals of the dentition of all vertebrates, including chapters on fishes.

Text in English. ★Owen, R. 1840.1; Wortman, J. L. 1886.1; ★Tomes, C. S. Add. 1914.1.

Text in German. Baume, R. 1882.1; Giebel, C. G. 1855.1; ★Terra, P. Add. 1911.1.

An excellent short non-technical account in English on the teeth of fishes, is ★Ride-wood, W. G. 1896.2.

Probably the most scholarly treatises in German are those cited under ★Röse, C. 1892.1–1896.1, 1897.1.

Miscellaneous topics

Homology of hair with teeth of shark. Brandt, A. T. 1898.2.

Origin of perforations in teeth of a fossil Carcharodon. Burrows, H. A. 1876.1.

Suppression and specialization of teeth. Humphreys, J. 1889.1.

Fishes' teeth contrasted with those of other classes. Menhuir, W. H. 1902.1.

Nerve terminations in teeth of Teleostei. Retzius, M. G. 1892.9.

Structure and anchorage in vertebrates. Struck, W. 1915.1; Watson, G. W. 1900.1.

Origin of teeth

The identity in development and structure of the placoid dermal elements (shagreen denticles) with the teeth, in Elasmobranchs, was recognized in Williamson, W. C. 1849.1, and elaborated in ★Hertwig, O. 1874.1.

During the inpushing of the outer skin in the formation of the stomodæum, these placoid elements (teeth) have been carried into the oral cavity. While teeth are generally restricted to supporting bones or cartilages, in numerous species of sharks and rays, practically unmodified placoid scales persist in the lining of the oral cavity and pharynx.

For references, see Imms, A. D. 1905.1; Spengel, J. W. 1905.1; ★Steinhard, O. 1903.1.

Similar oral and pharyngeal denticles in Chimæroids are figured in Dean, B. 1906.1, p. 121.

The formation of a triconodont tooth (in Chlamydoselachus), through the fusion of

three separate simple teeth, is shown in ★Röse, C. 1894.2.

Histology of teeth

Histological structure and development of teeth. Born, G. 1827.1; Fischer von Waldheim, G. 1801.1; Heincke, F. 1873.1; Hilgendorf, F. M. 1888.1; Morgenstern, M. 1909.1; Owen, R. 1839.4, 1840.3; ★Röse, C. 1897.1; Schwalbe, G. A. 1894.1; Waldeyer, H. W. 1864.1; Huxley, T. H. Add. 1853.1; Owen, R. Add. 1839.1.

ENAMEL

As early as 1848, M'Coy (Sir F. 1848.1, p. 124) following the then recognized fact that the enamel of fishes differs in development from that of mammals, applied the term "ganoine" to the layer of "false enamel" on the teeth of certain fossil sharks (*Chomatodus*). As pointed out to him by Prof. Owen (Owen, R. 1849.1) the latter's term "vitrodentine" had previously been in use. About the same time, Williamson (W. C. 1849.1, p. 438) independently, but more aptly, used the term "ganoine" for the enamel-like substance of the scales of *Lepidosteus*.

While the exact nature of enamel seems not yet entirely settled, a recent authority (Tomes, C. S. 1900.1, p. 62) retains the term "enamel" which he divides into the following types.

(1) Enamels not wholly epiblastic in origin. The stroma which is the seat of enamel calcification is furnished by a transformation of the exterior of the mesoblastic dentine papilla, the ameloblasts apparently segregating the lime salts required for its hardening. (This type is found in Elasmobranchs and is unquestionably a modified dentine — vitrodentine of Owen.)

(2) Enamels wholly epiblastic in origin, in which the ameloblasts undergo a prior transformation into a stroma of the dimensions of the finished enamel and themselves disappear. This type is met with in the Gadidae, in *Sargus* and in *Labrus* and probably other fishes.

(3 and 4) The other types, also epiblastic in origin but in which the ameloblasts persist, are confined to the mammals.

For papers specifically relating to development and structure of enamel, see Nunn, E. 1883.1, and ★Tomes, C. S. 1898.1–1900.1.

DENTINE

Although accurately described as early as 1836 by Retzius (A. J. 1836.1), the various forms of dentine were not named until the appearance of the "Odontography" of Owen (Owen, R. 1840.1) whose terms are now generally accepted.

As more precisely defined by Tomes (C. S. 1878.2), the forms now recognized are (1) hard unvascular dentine, (2) vaso-dentine, (3) plicidentine (*Labyrinthodon*, not in fishes), and (4) osteo-dentine.

Structure and development of dentine. Korff, K. 1910.1; ★Mummery, J. H. 1893.1; Studnička, F. K. 1906.2, 1909.2; Sternfeld, B. Add. 1882.1; ★Tomes, C. S. 1878.2.

Cornified epithelial teeth of Cyclostomata

In this group the teeth are purely cuticular, formed by an axial dermal papilla, invested by epidermis and an external horny cone. They are without genetical relations to the teeth in other groups.

In *Myxine* and *Bdellostoma*, according to Beard, the dermal papilla develops an imperfectly calcified tooth beneath the epidermal cornification.

Dentition — Cont'd.

Development, structure, and arrangement of teeth in various genera, chiefly Petro-myzon. Beard, J. 1888.7, 1889.1; Behrens, G. 1891.1; ★Jacoby, M. 1894.1; Renaut, J. 1900.1; Scott, W. B. 1883.2; Tims, H. W. 1906.1; ★Warren, E. 1902.1; Studnička, F. K. Add. 1900.1.

Dentition of Plagiostomi

Numerous genera of fossil sharks, whose relationships, in many cases, are but imperfectly known, have been described from isolated teeth. It is obviously beyond the sphere of the present work to adequately refer to these genera. They are, moreover, carefully treated in Woodward's "Catalogue of the fossil fishes in the British Museum" (Woodward, A. S. 1889.2), to which reference may be made.

There are a large number of Pre-Linnæan references to isolated fossil shark teeth, which were known as glossopetræ, and to the fossil teeth of pycnodont fishes known as bufonites (toad-stones, i. e., stones supposed to have been formed in the head of a toad). These are brought together under Palæontology.

The myth of the toad-stones is discussed in Hussakof, L. 1915.3.

Important treatises in German, chiefly inaugural dissertations, on the development and histological structure of Selachian teeth. Benda, C. 1881.1; ★Hertwig, W. A. 1874.1; ★Jentsch, B. 1897.1; ★Laaser, P. 1900.1, 1903.1; Owen, R. 1839.3, 1840.4; ★Röse, C. 1897.1; Treuenfels, P. 1896.1.

Numerous shark teeth were dredged in the tropical Pacific by the Albatross. See Eastman, C. R. 1903.6, 1906.3.

Histology and development of the rostral teeth of the sawfish, Pristis. ★Engel, H. 1909.1; Green, J. 1859.2; Hilgendorf, F. M. 1888.1; Kölliker, R. 1860.5.

Peculiar modified flattened posterior teeth occur in the Port Jackson shark, Cestracion. Miklukho-Maklai, N. N. 1879.1.

Dentition of the eagle rays, Myliobatidæ. These possess both an upper and lower median series of modified, flat, pavement-like, crushing teeth. ★Gudger, E. W. 1910.2, 1914.1; Harless, E. 1847.1; ★Stefano, G. 1914.2; Stromer, E. 1904.1; Treuenfels, P. 1896.1.

Sexual differences chiefly in the shape and size of the teeth have been described in the following forms. — *Raja*. Lütken, C. F. 1874.3, 5. — *Notidanus* (*Heptanchus*). Macdonald, J. D. & Barron, C. 1868.1. — *Mobula*. Pellegrin, J. 1912.12.

The evolution of sharks' teeth. Woodward, A. S. 1892.4.

Fine figures of the teeth and of the jaws with teeth of Plagiostomes may be found in Garman, S. 1913.1.

Descriptions of individual teeth or the complete dentition of the following forms. — *Carcharias*. Ayres, W. O. 1849.5. — *Rhineodon*. Bean, B. A. 1905.2; Gudger, E. W. 1915.1. — *Hexanchus*. Carruccio, A. 1896.1. — *Notidanus primigenius*. Probst, J. 1858.1. — *Chlamydoselachus*. Röse, C. 1894.2. — *Mustelus*. Spengel, J. W. 1905.1. — *Lamna*. Stannius, F. H. 1842.1. — *Cetorhinus*. Turner, W. 1879.2.

Dentition of various fossil Elasmobranchs. — *Cladodus*. Claypole, E. W. 1895.6; Eastman, C. R. 1900.1. — *Acanthodei*. Dean, B. 1907.2. — *Cochliodontidæ*. McCoy, F. 1852.1; Owen, R. 1867.3, 4.

Miscellaneous and usually unimportant papers on sharks' teeth or the dentition, succession, etc. Agassiz, J. L. 1844.5, 1874.2; André, W. 1784.1; Balkwill, F. H. 1875.1; Bicknell, E. 1872.1; Cocco, L. 1896.1; Forbes, H. O. 1879.1; Grube, A. E. 1878.2; Waldow, — 1911.1.

Miscellaneous early references to sharks' teeth, to be found in Pre-Linn. section. Geoffroy, C. 1741.1; Hérissant, F. 1753.1; Lister, M. 1674.1.

Dentition of Holocephali

The dental plate of Chimæroids (Callorhynchus) develops from a single enlarged flattened tooth according to Schauinsland, H. H. 1903.1 (p. 13, pl. 20).

General remarks on Chimæroid dentition. Hilgendorf, F. M. 1886.1.

Dental plates of Jurassic Chimæroids. Jaekel, O. M. 1901.1.

Dentition of Dipnoi

Homology with Dinichthys. Gill, T. N. 1879.4.

Teeth; Upper Silurian forms. Rohon, J. V. 1899.1.

In Neoceratodus, as shown by Semon, the dental plates arise by the fusion of a number of separate small teeth. Briquel, M. P. 1898.1; ★Semon, R. W. 1899.2, 1901.5.

Dental plates of numerous fossil species of Ceratodus. Böklen, H. 1887.1; Miall, L. C. 1878.1, 3; Woodward, A. S. 1907.1.

Histology of teeth of Protopterus. Owen, R. 1840.2; Röse, C. 1892.1.

Dentition of Lepidosirenidæ. Stromer, E. 1910.2.

Dentition of Teleostomi

Development and histology of teeth in Teleostei. Carlsson, A. 1894.1; ★Friedmann, E. 1897.1; Ghigi, A. 1905.1, 2; Röse, C. 1897.1; Tomes, C. S. 1875.1–1900.1.

CHONDROSTEI and HOLOSTEI

The Acipenseridæ, according to Zograf, possess teeth while young. From the sterlet (*Acipenser ruthenus*), in which they are lost at the age of one year, a series extends to *Psephurus gladius* which retains them throughout life. *Polydon* likewise retains its teeth when mature.

References. Murray, A. 1871.1; Parker, W. K. 1881.1 (pl. 14, fig. 6); Pavlov, H. 1879.1; Peltzam, E. 1870.1; ★Zograf, N. Y. 1887.5, 1896.2.

Lepidosteidæ. Barkas, W. J. 1878.2. — *Lepidosteus, analogies with labyrinthodonts.* Wyman, J. 1844.1.

TEETH OF TELEOSTEI

Most systematic treatises include descriptions of the form and arrangement of the teeth. Numerous genera are based on such characters.

It is thus obviously out of question to attempt to give a complete list of references here. The following citations are to separate papers dealing with the dentition of the forms named.

Anarrhichas and *Chaetodon*. André, W. 1784.1. — *Scaridae*. ★Boas, J. E. 1879.2. — *Orthogoriscus*. Hilgendorf, F. M. 1893.1. — *Salmonidae*. Knox, R. 1855.1. — *Echeneis*. Mummery, J. H. 1899.1; Murray, A. 1856.1. — *Gymnodontes*. Owen, R. 1839.4, 1840.3. — *Piabuca*. Rowntree, W. S. 1906.1. — *Cyclopterus*. ★Schmidt, B. 1913.1. — *Esox*. Tomes, C. S. 1878.1. — *Mugil*. Troschel, F. H. 1865.1. — *Loricariidae*. Weyenbergh, H. 1875.2. — *Anarrhichas*. Wilson, A. 1879.1,2. — *Labrus*. Wright, J. 1870.1. — *Hydrocyon*. Eastman, C. R. Add. 1917.1. Although *Coregonus wartmanni* is toothless when adult, true rudimentary teeth occur in embryos of 1 cm. Walter, H. E. 1894.1.

Pharyngeal teeth of Teleostei

In certain Teleosts occur clusters of grinding teeth (pharyngeal teeth) capable of replacement by vertical succession.

The lower pharyngeals are usually composed of the paired ceratobranchial elements of the last (fifth) branchial arch which is reduced on each side to this element.

In the Cyprinidae these grind against a callous pad above on the basi-occipital.

In the Labridae they are opposed above by the upper pharyngeal teeth formed on the pharyngobranchials of the posterior branchial arches.

For an excellent series, with photographs, of the pharyngeal teeth of many different species, see ★Shepherd, C. E. 1913.1.

Pharyngeal teeth of Cyprinidae. Čerkašov, P. G. 1903.1; Fack, — 1897.1; ★Gracianov, V. I. 1900.1; ★Hämpel, O. 1907.2, 1908.2,3; Hoppe, R. 1894.1; Jurine, L. 1821.2; Leonhardt, E. E. 1903.10; Molin, R. 1850.1; Nordmann, A. 1863.2.

Variability of pharyngeal teeth in Cyprinoid hybrids. Heincke, F. 1892.1.

Pharyngeal teeth of other fishes. — *Scaridae*. Boas, J. E. 1879.2. — *Labridae*, development. Prince, E. E. 1893.1. — *Orestias*. Pellegrin, J. 1904.12. — *Gerridae*. Sauvage, H. E. 1876.4. — *Labrus*. Wright, J. 1870.1.

Comparison of pharyngeals of Labrus from Italian Tertiary with those of recent Mediterranean species. Brunati, R. 1909.1.

Isolated fossil or sub-fossil pharyngeal teeth were earlier known as "Serpent's eyes." See Jussieu, A. Pre-Linn. 1725.1.

DERMAL SKELETON (OF FISHES)

Comprising the morphology of the Exoskeleton, the Dermal Denticles, and the Scales.

The dermal fin-rays (dermotrichia), which constitute a part of the exoskeleton, are treated under Fins.

The dermal skeleton should properly include the "dermal" or "membrane bones," but these are necessarily treated under Skull.

Scales are usually included under the general term "integument." In the present work, however, under Integument, will be found references merely to the soft structures of the epidermis and the dermis.

Introductory

In the Cyclostomata the skin is soft and entirely lacking in hard structures such as denticles or scales. There is thus no suggestion of a dermal skeleton in this group.

In the Elasmobranchs, however, true "placoid" denticles are present. These, more fully described below, consist of separate hollow cones of dentine capped by "enamel." Each separate denticle, with growth, develops a more or less expanded basal portion, the "basal plate." In these fishes, true bone never develops.

In the higher bony-fishes (Teleostomes) and in the Dipnoi the true scales occur. These develop, usually as oval flattened structures, in pockets within the dermis and are at no time contributed to by the epidermis. They grow throughout life by the deposition of successive layers of bony substance.

Agassiz (J. L. 1833.2) divided fishes into the four groups, Placoidae, Ganoidei, Cycloidei, and Ctenoidei, based on the characters of their scales. That this arrangement was untenable, especially for the higher groups, was soon shown by the experience of one of his students, Prof. N. S. Shaler (Atlantic Monthly, Feb., 1909, p. 222), who discovered that one species of Pleuronectidae "had cycloid scales on one side and ctenoid on the other." Likewise Peters (W. C. H. 1841.1) soon showed that the bonito (*Sarda*) possesses both cycloid and ctenoid scales. Agassiz (1850.6) decided that the scales of the bonito were intermediate and sometime later (1857.2) he definitely renounced his classification as being too artificial.

Except among palaeontologists, where often the scales of certain fossil forms constitute the only remains preserved, the scales have not been much studied as an aid in the classification of fishes.

More recently Cockerell (T. D. 1909.4-1914.1) has assiduously studied and described the minute structure of the scales of many species in all groups, especially the Teleostomes, with the idea of defining the distinctive characters which may aid in the determination or identification of the species. The taxonomic value of "lepidology" has however not since been extended.

Principal literature

Modern views on the morphology and development of scales had their inception in the works cited under ★Williamson, W. C. 1849.1, and 1851.1.

The most comprehensive treatises in German, on the morphology of dermal (placoid) denticles and scales are ★Hertwig, O. 1876.1; and ★Klaatsch, H. 1890.1.

By far the most illuminative memoir (in English) on the development, structure, and phylogeny of denticles and scales is ★Goodrich, E. S. 1908.1.

Most of the previous views on the development and formation of scales are reviewed in English in ★Thomson, J. S. 1904.1.

As stated above, Cockerell (T. D. 1909.4-1914.1, Add. 1914.1) has described the superficial characters of the scales of many genera and species of fishes. See especially ★Cockerell, T. D. 1911.5 and 1913.1.

Miscellaneous papers

Mechanical considerations of the evolution, or causes of the arrangement and shape of scales. Ryder, J. A. 1892.1; Woodward, A. S. 1893.5.

Older or miscellaneous and unimportant papers on the structure and manner of growth of the scales of fishes. Agassiz, J. L. 1840.2,3,4; Alessandrini, A. 1849.1;

Dermal Skeleton — Cont'd.

Baster, J. 1762.2, 3; Benecke, B. 1882.1; Broussonet, P. M. 1787.1; Couch, J. 1868.2; Delsman, H. C. 1913.2; Hennah, T. H. 1873.1; Keene, J. H. 1879.2; Kuntzmann, J. H. 1829.1; ★Mandl, L. 1839.1–1840.1; Peters, W. C. 1841.1; Salbey, R. 1868.1–1870.1; Schmula, — 1854.1; Steeg, G. 1857.1, 1861.1; Swaine, L. H. 1870.1; Anon. 173, 526, 599; Engström, A. Add. 1874.1; Huxley, T. H. Add. 1855.1.

The chief points in many of these older papers are reviewed in Baudelot, E. 1873.4; and in Thomson, J. S. 1904.1.

The scales of fishes were among the first objects examined by the early microscopists. The following references, partly referring to such observations, will be found in the Pre-Linn. section. Fabricius d'Aquapendente, J. 1618.1–1625.1; Hooke, R. 1665.1; Leeuwenhoek, A. 1686.1–1719.2.

EVOLUTION OF THE PROTECTIVE COVERING**Phylogeny of scales**

Williamson (W. C. 1849.1, p. 466) attempted to outline the derivation of the Teleostome scale from the denticle of the Elasmobranch. He believed that by the fusion of the basal plates of a number of adjacent denticles a large composite denticle was formed. By the successive depression or insinking of this composite denticle (ultimately to entirely within the dermis), by the obliteration or disappearance of the separate tips of the denticles (aggregated to form the "cosmine" layer), and by the acquisition of a basal film of true bone which subsequently overlaps the outer surface, the true scale has been formed.

These views, with modifications, have been adopted by Hertwig, (O. 1876.1), by Wiedersheim (R. E. 1880.4), and by others. Klaatsch (H. 1890.1) believed that each scale represents a single denticle of which the basal plate has become greatly enlarged.

According to Goodrich (E. S. 1908.1), the views of Williamson are not without difficulties, the chief of which is the lack of intermediate stages between the denticle and the Cosmoid scale. While in general adhering to Williamson's views, Goodrich considers the elements of the dermal skeleton to be divisible into two distinct forms as follows:

(1) The dermal denticle of Elasmobranchs, of which the "basal plate" is simply the expanded lower portion of the external cone.

(2) The scale of Teleostomi-Dipnoi, divisible into Cosmine and Ganoid types. The essential part of the scale is the development in the dermis of a bony plate. The overlying denticles may have subsequently become fused to this plate and by aggregation or fusion may have become reduced to the cosmine layer. While the denticles have generally become lost since the appearance of scales, in certain forms (Lepidosteus, Polypterus and some Siluroids), minute denticles persist and become secondarily attached to the scales and to the dermal fin rays (lepidotrichia).

DENTICLES**The so-called Placoid Scale of the Elasmobranchii**

"True denticles are universally present in the living Elasmobranchs and their extinct allies.

"The placoid scale, or denticle, begins as a cone of dentine deposited by mesoblastic scleroblastic cells below the epidermis, in continuity with the basement membrane; a basal plate may be present in the form of a direct extension inwards of the cone, never as a separate element which becomes fused on to it secondarily; both the cone and the plate are composed of dentine or some allied substance, never of true bone; the cone may pierce the epidermis, when fully grown." Goodrich (1908.1, p. 753).

The outer surface of the denticle is covered with a hard, enamel-like layer of which the exact nature has been much disputed. As has been stated elsewhere (see Dentition), the identity of the teeth and denticles ("dermal teeth") in Elasmobranchs has long been recognized. Röse (C. 1897.1) considered the enamel-like layer of the denticles and teeth to be a layer of dentine (vitrodentine). The arguments for and against its being enamel are summarized by Scupin (H. 1896.1). Although recognizing the primary part played by the mesoblastic dentine papilla in its formation, instead of its being wholly an epidermal secretion as is the true enamel of higher vertebrates, Tomes (C. S. 1898.1, p. 460) believes that this layer may be appropriately called *enamel*. It is not a dentine because there is no collagen matrix. For additional remarks on "Enamel," see under Dentition.

As pointed out by Steenstrup (J. J. 1861.2, 3), although probably incorrectly denied by Nardo (G. D. 1861.1), the denticles do not persist throughout the life of the shark and constantly increase in size as do the scales, but are shed individually to make place for others. They are subsequently replaced by the growth of newly developed denticles between the old ones.

Plagiostomi

Papers relating to the development, structure, and histology of the denticles or "placoid scales" of sharks and rays. Benda, C. 1881.1; Brackel, G. 1858.1; Green, J. 1859.2; Hannover, A. 1868.1; ★Hertwig, O. 1874.1; ★Klaatsch, H. 1890.1; ★Kwietniewski, C. 1905.1; Meyer, P. 1886.1; ★Burckhardt, C. R. Add. 1902.1.

For excellent figures of the denticles of certain sharks and rays, see Garman, S. 1913.1, and Radcliffe, L. 1916.1.

The exoskeleton of *Heterodontus francisci*. Daniel, J. F. Add. 1914.1.

Holocephali

In the existing Chimæroids the skin is generally smooth but a few denticles are retained in rows along the head and back of young specimens. These are distinctly shark-like.

In addition, the males of all recent Chimæroids possess denticles, quoting from Dean (B. 1906.1, p. 117), "on the frontal clasp organ, on the mixipterygium, and on the anterior pelvic clasp organ. These denticles have a transparent almost glassy character. In the frontal clasp organ of *Callorhynchus*, they occur not only at the tip of the organ itself, but also proximalward and at the front and sides of the depression into which this clasp organ fits; but in the other genera, the denticles are limited only to the tip of this organ."

For a full discussion of the denticles in both recent and fossil members of this group, see ★Dean, B. 1906.1, pp. 114–118.

In Chimæra and Hydrolagus, Cockerell records oval horseshoe-shaped denticles, which line and serve to keep open a mucous canal, lying below the dorsal denticles. Cockerell, T. D. 1913.3.

Certain fossil Chimæroids, Squaloraja and Myriacanthus, possess an enlarged frontal spine or tentaculum, evidently a frontal clasper, probably derived from denticles. Davies, W. 1872.1; Reis, O. M. 1895.2; Woodward, A. S. 1906.3.

Dermal plates of the Ostracodermi

Concerning the exoskeleton of this early problematical group, we can do no better than quote from Goodrich (1908.1, p. 754), with necessary adaptations in reference numbers.

"The important researches of Traquair (R. H. 1899.2,3) have disclosed a most interesting series of Palæozoic fish in which it appears to be possible to trace clearly the evolution of the bony carapace of the Pteraspids from the simple placoid scales of *Thelodus*. The latter are broad and flattened denticles. . . . Rohon (J. V. 1889.2, 1893.1) and Röse (C. 1897.1) have described their finer structure. The pulp cavity is simple and there is no distinctly marked basal plate. . . . *Psammosteus* is almost entirely covered with large plates (Traquair, R. H. 1899.3). Superficially these are studded with small denticles in every way similar to those of *Thelodus*. . . . Below these denticles is a thick plate of bone-like tissue, which, however, is devoid of bone cells.

"The denticles . . . rest on the underlying plate, to which they become fixed, being fused to it here and there at their base. . . .

"It is but a step from *Psammosteus* to *Pteraspis*, whose exoskeleton has been well described by Huxley (T. H. 1858.2) and Lankester (E. R. 1864.2, 1865.1). . . .

"Thus it appears that the shields of the Heterostraci, and also the scales and dermal fin-rays, have all been evolved by the combination of a covering of separate isolated denticles and an underlying plate, and the theory of Williamson is confirmed in a most remarkable manner by Traquair."

Professor Goodrich, having read proofs of this section, suggests:

"In the same way, within the *Osteostraci*, we can trace the development of a complete armour of scales and plates from primitive separate denticles which become fused on to underlying plates of true bone with bone cells."

THE TRUE SCALES

As stated above, Goodrich divides the scales previously known as "ganoid" into two types, the *cosmoid* of which the scale of *Megalichthys* (*Osteolepidæ*), well described by Williamson (W. C. 1849.1), is an example and the *ganoid* which is further divisible into two varieties.

A *cosmoid* scale grows only by the addition of new cosmine at the edge and of isopedine (bone) on the lower surface. No living fish has a *cosmoid* scale. Among extinct forms it occurs only in the extinct *Crossopterygii* and in the *Dipteridæ*.

The Ganoid scale

The "ganoid" scale, as restricted by Goodrich, is found in all recent "ganoids" (Goodrich's *Actinopterygii*). It does not occur in the *Teleosts*.

These scales are generally thick and rhomboid. They grow by the deposition of concentric layers over the whole surface, the oldest part of the scale being at the center. These layers on the lower surface are bony or fibrous; on the outer surface they are of the enamel-like substance called, in the case of *Lepidosteus*,

ganoin by Williamson (W. C. 1849.1, p. 438). As shown by Hertwig and by Nickerson, the *ganoin* is entirely mesoblastic in origin and has no relation to enamel.

Goodrich (1908.1, p. 757) divides the ganoid scale into two distinct varieties, the "Palæoniscoid" type and the "Lepidosteoid" type. The latter is pierced by characteristic tubules, found also throughout the bony skeleton of living and fossil *Amioidei* and *Lepidosteoides* (Goodrich, 1913.2).

Histological structure of "ganoid" scales in numerous fossil genera. Klaatsch, H. 1890.1; ★Scupin, H. 1896.1.

Structure of the scales in Polypterus. Hertwig, O. 1876.1; Leydig, F. 1854.1; Reissner, E. 1859.1; Scupin, H. 1896.1.

The presence of small scales in the integument of Polyodon is recorded in Collinge, W. E. 1895.1.

In Acipenser, the scales are relatively few, large plates composed of concentric layers of bone, entirely lacking the ganoin layer. Agassiz, J. L. 1856.1; ★Hertwig, O. 1876.1 (vol. ii); Kosmak, G. W. 1895.1.

Structure and development of the scales in Lepidosteus. Agassiz, J. L. 1856.1; Hertwig, O. 1876.1 (vol. v); ★Nickerson, W. S. 1893.1; Reissner, E. 1859.1.

In Amia the scales are thin and the ganoin vestigial. Unimportant references are Green, J. 1862.1; and Mackintosh, H. W. 1878.1.

Scales of Teleosts

The scales of *Teleosts*, although presenting great variations in form and structure, are in general thin and flexible and develop within dermal pouches. Their posterior edges usually slightly overlap the following scale.

Scales increase in size by the deposition of fine excentric rings entirely around the outer margin. These rings have been termed *growth-rings* (*Zuwachsringe*) and the fine lines limiting the growth rings are the *lines of growth* (Thomson, J. S. 1902.1).

During summer, with its favorable conditions for growth, the scale rapidly increases in size and the lines of growth are relatively far apart, but during the following winter, the growth-rings become fewer and narrower and the lines of growth consequently become crowded together. This variation produces a distinct appearance, the *annual ring* roughly comparable to the rings in many trees. These annual rings, as first demonstrated by Hoffbauer (C. 1898.1 *et seq.*), supply us with an index to the age of the fish.

The growth and annual rings have been much studied in recent years in connection with the determination of the age and growth of fishes. This constitutes a separate subject with an extensive literature, for which see "Recent methods in age determination" under Growth and age.

The scales grow continuously throughout life. If broken off or otherwise injured, they possess the power of regeneration (Mohr, E. 1914.1; Scott, W. 1911.1). Ryder (J. A. 1884.4) records that a carp, in which a scale had been detached, had, after five months, replaced the lost scale with one of the same size but thinner and also lighter in color. The condition of the growth-rings was not determined.

Cycloid and ctenoid scales

As indicated above (under Introductory remarks), the differences between cycloid and

Dermal Skeleton—Cont'd.

ctenoid scales, once thought fundamental, have been gradually shown to be unimportant. Cycloid scales may be defined as those which possess a smooth posterior margin; and ctenoid, those in which this margin is produced into a series of small spines. Reduced to the simplest terms, as shown by Cockerell & Moore (1910.2) and independently corroborated by Hase (A. 1911.1); when the growth-rings or circuli are parallel with the margin, the scale is cycloid. When, however, the growth-rings strike the posterior scale margin at a right angle or perpendicularly, their truncated ends form tooth-like spines and the scale is ctenoid. Each growth-ring may produce a spine or several may unite to form one spine (Hase).

Mandl (L. 1839.2), Vaillant (L. 1875.2) and Tims (H. W. 1905.1) erroneously believed the "teeth" of ctenoid scales to be homologous with the spines of the denticles of sharks. The correct view that they are merely projections of the posterior scale border, first propounded by Agassiz (L. 1840.3) in opposition to Mandl, has been held also by Baudelot, Carlet, Hofer, Klaatsch, and others.

Morphology of scales

Papers primarily on the development of scales, both cycloid and ctenoid, including their microscopic structure. ★Baudelot, E. 1873.4; Carlet, G. 1878.1, 1879.1; ★Grunelius, A. 1913.1; ★Hase, A. 1907.1; Hofer, B. 1889.1; ★Nusbaum, J. 1907.1; Rosén, N. 1915.1; Tims, H. W. 1905.1; Ussow, S. A. 1897.1.

Although the Characinidae ordinarily possess cycloid scales, Gill enumerates four subfamilies with ctenoid scales. Gill, T. N. 1896.11.

Each scale of the lateral line is pierced by a pore of the lateral line canal. These references describe the lateral line scales in the following. —Scopelidae. Cohn, L. 1907.2. —Mugil. Fée, F. 1869.1. —Sciænidae. Sauvage, H. E. 1877.4. —Serranidae. Vaillant, L. L. 1874.2.

Johnstone describes a flounder having part of the scales spinulated. Johnstone, J. 1904.1.

The Plectognathi including the Sclerodermi, containing the Trigger-fishes (Balistidae), File-fishes (Monacanthidae), Globe-fishes (Tetradontidae), and Porcupine fishes (Diodontidae), have the body encased in heavy plate-like scales or, as in the Porcupine fish, Diodon, have the scales produced into sharp spines. Consult Dareste, C. 1850.2; Hertwig, O. 1876.1 (vol. vii); Hollard, H. L. 1853.1, 1860.1; ★Rosén, N. 1912.1 (iii); Kaschkaroff, D. N. Add. 1914.1.

The Trunk-fish (Ostracion) is encased in a rigid cuirass resulting from the union of rhomboidal plates placed side by side, which possess an inferior layer of a horny nature and a superior layer of osseous substance. Hollard, H. L. 1857.2.

The Lophobranchii, including the Pipe-fish (Syngnathus) and the Sea-Horse (Hippocampus), have the body protected by a series of dermal scutes forming rings. See Hoyer, H. 1901.1; Kasanzeff, W. 1906.1; and Schäff, E. A. 1886.1.

The John Dory (Zeus faber) possesses a series of bony plates or spines along the

base of the median fins. For their number and arrangement, see Byrne, L. W. 1902.3.

The scales of Centriscus possess sharp spines and were thought to be intermediate between denticles and scales. Hertwig, O. 1876.1 (vol. vii, p. 15); Vaillant, L. L. 1888.1.

Separate papers have appeared describing the structure of the scales in the following forms. —Cyclopterus. ★Hase, A. 1911.2. —Anguilla. Jourdain, S. 1880.1. —Zoarces. Quekett, J. T. 1852.2. —Gobius. Vaillant, L. L. 1875.2. —Chaunax. Vaillant, L. L. 1888.1. —Perca, Gobius, and Platessa. Winther, G. P. 1872.1.

Scales of the American and Asiatic Cyprinidae. Cockerell, T. D. & Allison, E. M. 1909.1; Cockerell & Callaway, O. 1909.1; Cockerell & Moore, E. V. 1910.1.

Scales of Dipnoi

In the recent lungfishes, the scales are cycloid and overlapping and sunk deep within the dermis.

References are Cockerell, T. D. 1911.7; Günther, A. (Neoceratodus) 1871.4; Klaatsch, H. 1890.1; Kölliker, R. A. (Protopterus) 1860.1; Wiedersheim, R. E. 1880.4.

Chemical composition of denticles and scales

The scales of Teleosts are composed chiefly of mineral matter, collagen, and ichthylepidin, the latter forming about one-fifth of the organic substance.

Ichthylepidin, which is close to elastin, was discovered by Mörner. It is insoluble in hot and cold water as well as in cold dilute acids or alkalis, but on boiling with the latter it dissolves. It responds to Millon's reagent and blackens, from loosely combined sulphur, when boiled with an alkaline solution of lead acetate.

Mörner found it to occur in the scales of twelve species of Teleosts examined but found it lacking in Lepidosteus. Green & Tower, examining the scales of thirty-five species of Teleosts belonging to widely separated families, found it to occur in all except the ocean sunfish (Mola) and the puffer (Spheroides). They found that it occurs in Acipenser.

The denticles of Elasmobranchs, however, have collagen as their organic basis. Four species of sharks and rays examined showed no trace of ichthylepidin.

Earlier papers on the composition of scales. Green, J. 1858.1–1862.1; Weiske, F. 1883.1; Wicke, W. 1853.1.

Jackson records the presence of fluorine in the scales of Lepidosteus. Jackson, C. T. 1856.2.

Nature and occurrence of ichthylepidin. Green, E. H. & Tower, R. W. 1902.1, 2; Mörner, C. T. 1898.1, 1902.1.

Economic uses of shark and other fish skins

Formerly pieces of sharks' skin with the attached hard denticles (shagreen) were used by cabinet makers for polishing wood and ivory. At present the production of other abrasives has largely resulted in their disuse. Such "shagreen" was very durable, a piece outwearing many sheets of sandpaper of equal area.

Similarly the dried or tanned skins of fishes have been used to some extent as ornamental leathers for covering small ornamental objects

such as jewel boxes, card cases, knife and sword sheaths, etc.

These matters have been fully treated by C. H. Stevenson in "Utilization of the skins of aquatic animals," in Rept. U. S. Comm. Fisheries, 1902 (1904), part xxviii, pp. 281-352.

Vaillant (L. L. 1911.1) has recorded the use of the skin of the puffer (*Tetrodon*) for bags and other ornamental objects in Siam.

The natives of the South Sea Islands often wear helmets made of the skin, with the attached spiny scales, of the porcupine fish, *Diodon*. For references, see Hartzer, F. Add. 1900.1; Wilkes, C. Add. 1845.1; and especially E. W. Gudger in Bull. N. Y. Zool. Soc. 1919, vol. xxii, pp. 126-131.

DIGESTION IN FISHES

The basic literature on this subject is largely in German. For a complete résumé of the literature, consult ★Biedermann, W. Add. 1911.1.

For a comprehensive treatise in French, consult ★Yung, E. J. Add. 1899.1.

For works in English, consult Alcock, R. 1891.1, 1899.1; Stirling, W. 1884.1, Add. 1884.1; ★Sullivan, M. X. 1905.1; Van Slyke, D. D. & White, G. F. 1910.1; Langley, J. N. & Sewall, H. Add. 1879.1.

Early work on digestion in fishes: Spallanzani placed tubes filled with flesh in the stomachs of fishes and noted digestion. Spallanzani, L. 1784.1.

Gastric juice argued to be alkaline, after mixture of stomach mucus with sublimate solution. Musgrave, W. Pre-Linn. 1684.1.

Enzymes, in addition to those treated below under Gastric, and Intestinal digestion. — General topic. ★Polimanti, O. 1912.7; Stirling, W. 1884.1, Add. 1884.1. — Zymogen in spleen. Boudouy, T. 1899.4. — Enzymes in liver of *Scyllium*. Buglia, G. & Constantino, A. 1913.1. — *Phillothion*, diastase of striated muscle. Rey-Pailhade, J. 1912.1. — Lipase in blood. Sellier, J. 1902.2,3. — Arginase of intestinal digestion. Clementi, A. Add. 1914.1.

Miscellaneous and unclassified papers on digestion. Brinton, W. 1862.1; Cajetan, J. 1883.1; Davy, J. 1860.1; Heynacher, — 1837.1; Kerb, H. 1910.1; Lipschütz, A. 1911.1,2; Pancritius, P. 1887.1; Tangl, F. 1899.1; Thesen, J. E. 1890.1; Zuntz, N. 1898.1; Home, E. Add. 1807.1.

For the occurrence of pebbles in the stomachs of fishes, presumably aiding in the trituration of food, see under Gastroliths.

Gastric digestion. Various papers on digestion in the stomach, changes in pepsin-forming glands, enzymes, etc. Cattaneo, G. 1886.1,3; Herter, E. 1891.1; ★Herwerden, M. A. 1908.1,2; Richet, C. R. & Mourrut, — 1880.1; Yung, E. J. 1898.1, 1899.1; Langley, J. N. & Sewall, H. Add. 1879.1.

Investigations by means of glycerin extracts of gastric epithelium. ★Krukenberg, C. F. 1877.1, 1879.1, Add. 1881.2; Luchau, E. 1877.1, 1878.1.

Acidity of stomach, nature of acid (HCl), determination of free acid, etc. Acidity often as high as 1.5 per cent of hydrochloric acid in *Scyllium*. Demonstrated by Richet,

Decker, and by Weinland that stomach is sometimes neutral or alkaline. Decker, F. 1887.1; Grohmann, A. & Steffen, T. 1910.1; Herwerden, M. A. 1908.2; Herwerden, M. A. & Ringer, W. E. 1911.1,2; ★Richet, C. R. 1878.1, Add. 1878.1; ★Weinland, E. 1900.1, 1901.1.

First recognition of (hydrochloric) nature of acid. Rabuteau, A. P. & Papillon, F. 1873.1.

Pepsin; first noted by Fick that pepsin of fishes differs from that of warm-blooded vertebrates in its ability to effect digestion at much lower temperatures. Variance of opinion in regard to optimum temperature. Consult Fick, A. E. 1873.1; Luchau, E. 1877.1, 1878.1; Hoppe-Seyler, F. Add. 1877.1; ★Rakoczy, A. Add. 1913.1.

At 12 to 15° C., large food said to remain undigested in stomach of rays up to eighteen days. Weinland, E. 1901.1.

Pepsin of the pike stomach easily destroyed by heating in its acid solution. Hammarsten, O. in Zeitschr. Physiol. Chem., 1908, Bd. 56, p. 47.

Intestinal digestion including the effects of the pancreatic juice, the secretion from the intestinal glands (*succus entericus*), and the bile. Normal occurrence of amylase or diastase, lipase or steapsin, and protease or trypsin in the pancreatic juice. Boudouy, T. 1899.1; Homburger, L. 1877.1; Knauth, K. 1898.1,2; ★Krüger, A. 1905.1; Krukenberg, C. F. 1877.1, 1879.1; Luchau, E. 1878.1; Müller, E. 1901.1; Sellier, J. 1899.1, 1902.1; ★Yung, E. J. 1898.2,3, 1914.1; Bernard, C. Add. 1856.1.

Functions of the pyloric appendages or cæcæ. (Said to produce diastatic and trypsin-like enzymes.) Blanchard, R. 1883.1; Boudouy, T. 1897.1; Boudouy, T. 1899.2-1899.5; Mordecai, E. R. 1882.1; Stirling, W. 1884.1, Add. 1884.1.

DISEASES OF MAN

For early ideas concerning the use of fishes in medicine, see under Medicinal properties.

For related topics, such as Sharks as man-eaters, etc., see under Predatory fishes.

General. Cleland, J. B. 1912.1. — Beriberi due to decomposing fish. Daland, J. Add. 1895.1.

For alleged penetration of the human urethra by the parasitic "Candiru" (*Vandellia*), see under Parasitic fishes.

For attempts to induce human tuberculosis in fishes, see Diseases caused by Bacteria under Pathology.

Diseases derived through eating fish

General. Day, F. 1871.3. — On leprosy and fish-eating. Hutchinson, J. Add. 1906.1. — Possibility of fish transmitting typhoid or cholera. Remlinger, — & Nouri, O. Add. 1908.1.

Parasites of the alimentary tract.

Opisthorchis (Distomum) felinus, parasitic in gall-bladder and bile duct of man:

Diseases — Cont'd.

derived from *Ide* and *Roach*. Askanazy, M. 1906.1; Roth, W. 1904.1.

Dibothriocephalus latus (tapeworm), found encysted especially in flesh of *Esox*, *Lota*, and *Perca*. Studies on its occurrence, etc. Järvi, T. H. 1908.1; Levander, K. M. 1906.2; Braun, M. 1903.1, Add. 1885.2, 1892.1, 1894.1; Leidy, J. Add. 1879.1; Linstow, O. F. Add. 1896.1; Pilat, A. Add. 1905.1; Rochaz, — Add. 1911.1; Schroeder, A. E. Add. 1896.1; Zschokke, F. Add. 1890.1, 1891.1.

For a more complete bibliography of these subjects, see ★Fantham, H. B., Stephens, J. W. & Theobald, F. V., "The animal parasites of man." London, 1916, and ★Rivas, D., "Human parasitology." Philad. & London, 1920.

Ptomaine poisoning. Records of cases, etc. Arustamoff, M. 1891.1; Cohn, H. 1879.1; Kesteloot, — 1841.1; Kobert, E. R. 1902.1; Lieventhal, C. 1887.1; Linstow, O. 1905.1; David, R. Add. 1899.1; Hirschfeld, — Add. 1885.1; J., L. Add. 1899.1.

Cases of poisoning by sardines. Addin-sell, A. W. Add. 1884.1; Stevenson, T. Add. 1892.1. — *Bacteria* (*Micrococcus prodigiosus* var.), cause of reddening of canned sardines, produce sickness. Auché, A. 1894.1; Loir, A. 1894.1.

Sickness caused by eating "red cod." Bérenger-Féraud, L. J. Add. 1884.1, 1885.1; Heckel, E. Add. 1887.1, 1888.2; Mauriac, E. Add. 1886.1, 1889.1; Millet, E. Add. 1886.1; Pouchet, G. Add. 1886.1. — For nature of "red cod" (bacterial), see Preservation under Fisheries.

Sickness from eating tunny. Lardier, — Add. 1891.1; Lussana, P. Add. 1894.1; Pagnoni, G. Add. 1894.1.

For *Ciguatera*, etc., or poisoning by eating fishes whose flesh contains alkaloids, see under Poisonous fishes.

Diseases diminished by fishes

Carp as an eradicator of liver-fluke disease (distomatosis) of cattle and sheep, in Columbia R. region. Stiles, C. W. 1902.1, Add. 1903.1.

Chub picking flies from cattle. Moodie, R. L. 1909.1. — Fishes picking mites from skin of men who lie immersed in the stream for that purpose. Anon. 235.

Fishes (experimentally) without influence on cholera vibrio. Cano, U. & Martinez, G. 1912.1.

Bacillus anthracis retains virulence after ingestion, not pathogenic to fishes. Schieppati, E. 1912.1.

Malaria combatted by fishes destroying mosquito larvæ. General. Lönnberg, A. J. 1909.2; Mark, E. L. 1890.1; Osborn, H. L. 1907.1; Seal, W. P. 1908.1, 1910.1; Underwood, W. L. 1901.1; Vosseler, J. 1908.1; Canaud, J. L. Add. 1913.1.

Introduction of top-minnows (*Poeciliidæ*) into — Africa. Gilchrist, J. D. F. 1913.2. — Hawaiian Is. Seale, A. 1905.1; Van Dine, D. L. [n. d.].

Millions fish (*Lebistes reticulatus*) of West Indies, as a destroyer of mosquito larvæ. Ballou, H. A. 1908.1; Bolten, D. G. 1909.1; Morris, D. 1911.1; Vipar, J. A. 1910.1; Henrivaux, J. Add. 1912.1.

Native fishes which have proven effective in India. Bannerman, W. B. 1910.1; Bentley, C. A. 1910.1; Chaudhuri, B. L. 1909.3, 1911.1; Freund, L. 1913.1; Seymour-Sewell, R. B. & Chaudhuri, B. L. 1912.1.

Native fishes of utility in — Uganda. Cowdry, C. C. 1911.1. — Nigeria. Graham, W. M. 1911.1. — New South Wales. Stead, D. G. 1908.2. — Italy. Supino, F. 1908.1. — Bismarck Archipelago. Börnstein, Add. 1914.1.

Numerous experiments made by the U. S. Bureau of Fisheries with fishes, to determine their availability in mosquito control, are detailed by ★S. F. Hildebrand (Rept. U. S. Comm. Fish. for 1918, Appendix IX, 15 p.), and by ★J. P. Moore (*ibid*, 1922, Appendix IV, 60 p.).

DISTRIBUTION OF FISHES

For references to all papers dealing with the fauna of a particular region, in many cases considering the problems of its origin and dispersal, see the particular region under Fauna of the world.

References to the distribution of particular fishes will be found under the various families and genera.

Geographical distribution

For an excellent summary of this subject, see ★Jordan, D. S. 1901.2, substantially reprinted in his 1905.1; much information will also be found in Meek, A. 1916.1.

For a general work comprising an enormous amount of detail, which is, however, poorly arranged, see Palacky, J. 1891.2, 1895.2.

General treatises on the geographical distribution of animals, including fishes. Marshall, W. A. 1887.1; Schmarda, L. K. 1853.1; Trouessart, E. L. 1890.1; ★Wallace, A. R. 1876.1, 2, 1880.1; Heilprin, A. Add. 1897.1.

European animals, their geological history and geographic distribution. Scharff, R. F. 1899.1, 1907.1.

The Pendulation theory. Simroth, H. R. 1907.1. — Bipolarity. Ortmann, A. E. 1897.1. — The principles of zoogeography. Gill, T. N. Add. 1884.5.

Miscellaneous papers on the distribution of fishes. Agassiz, J. L. 1850.2, 3; Boulenger, G. A. 1910.2; Cockerell, T. D. 1912.2; Dambeck, K. 1871.1, 1873.2, 1874.1, 1875.1; Dickson, H. N. 1895.1; Garman, S. 1892.2; Gill, T. N. 1875.1; Jordan, D. S. 1901.3, 1902.3; Kner, R. 1860.4; Knipovich, N. M. 1903.2; Meek, A. 1915.1; Meek, S. E. 1900.1; Ortmann, A. E. 1901.1, 1904.1; Pfeffer, G. J. 1891.1.

Geographical distribution of various groups of fishes. — *Percoidea*. Baird, S. F. 1873.15; Vaillant, L. L. 1872.2. — *Galaxiidae*. Boulenger, G. A. 1902.15. — *Gadidae*. Dambeck, K. 1877.1, 1879.1;

Redeke, H. C. 1909.1; Thompson, D. W. 1910.1, 1911.1, 3, 1912.3. — *Selachii*. ★Engelhardt, R. 1913.1; Simroth, H. R. 1907.2. — *Scorpænidæ*. Sauvage, H. E. 1874.1. — *Cephalochordata*. Tattersall, W. M. 1903.1.

For maps showing geographical distribution of various fishes, see Boulenger, G. A. 1904.7, and Meek, A. 1916.1.

FRESH-WATER FAUNAS

Base-leveling and its faunal significance. Adams, C. C. 1901.1. — *Supposed identity of fishes of North America and Europe*. Gould, A. A. 1848.1. — *Relics of glacial period*. Menke, H. 1914.1.

Dispersion of fresh-water fishes. ★Jordan, D. S. 1887.9.

Possibility of dissemination of fishes by their eggs attached to aquatic birds or insects (considered probable). Paratre, R. 1894.1.

Possible former connection between Australia and New Guinea. Beaufort, L. F. 1910.1; Weber, M. C. 1907.3, 1908.1.

Relation of the Indian and African fresh-water fish-faunas. Day, F. 1885.12.

Archiplata-Archhelenis theory for origin of South American fauna. Eigenmann, C. H. 1909.3.

Zoogeographical relations between Asia and Australia. Popta, C. M. 1912.3.

Discussion of Wallace's line in Oceanica. Regan, C. T. 1912.11.

Evidence for a Scottish-Norwegian land bridge. Stejneger, L. 1909.1.

MARINE FAUNAS

Comparison, Atlantic faunas of Europe and America. Agassiz, J. L. 1858.3.

Zoogeographical relations of North Pacific. Dall, W. H. 1877.1; Schmidt, P. Y. 1904.5.

The distribution of antarctic and sub-antarctic fishes. The antarctic continent during the Tertiary period. Regan, C. T. 1914.1.

Indo-Pacific basin, relicts in fauna. Stromer, E. 1910.3.

On a supposed resemblance between the marine faunas of the arctic and antarctic regions. Thompson, D. W. 1897.1.

Laws controlling distribution of marine fishes. Tillier, L. 1879.1, 1881.1.

Influence of the construction of the Suez Canal upon the intrusion of the Red Sea fauna into the Mediterranean Sea and vice versa. Tillier, J. B. 1902.1; Tillier, M. 1913.1; Krukenberg, C. F. Add. 1882.1.

Various papers on the distribution of marine fishes. Chun, C. 1886.1; Dahl, F. T. 1895.1; Dambeck, K. 1873.1; McIntosh, W. C. 1904.2; Ortmann, A. E. 1896.1; Quoy, J. R. & Gaimard, P. 1824.2; Troschel, F. H. 1869.1; Valenciennes, A. 1838.1.

Vertical distribution

For the dissolved gases as factors in determining vertical distribution in inland lakes, see under Ecology.

For all conditions determining bathymetric distribution in the depths of the ocean, see under Deep-sea fishes.

General account. Dambeck, K. 1875.1;

Mountain fauna of Sweden. Ekman, S. 1907.1. — *Abyssal fauna of Lake Michigan*. Hoy, P. R. 1870.1. — *Fishes of Peruvian Andes*. Steindachner, F. 1876.3. — *Mountain fauna of Westphalia, Prussia*. Thienemann, A. 1912.1.

Fauna of the high alpine lakes of France and Switzerland. Buniva, M. F. 1802.1; Imhof, O. E. 1883.1–1894.1; Keilhack, F. L. 1907.1; ★Tschudi, F. 1872.1; ★Zschokke, F. 1890.1, 1895.1, 1900.1, 1911.1.

Abyssal fauna of Swiss lakes. Asper, G. 1880.2; Du Plessis, G. 1885.1; ★Forel, F. A. 1872.1, 1874.2, 1885.1.

See also under Fauna, for other lakes of high altitude, such as Titicaca Lake in South America.

ECOLOGY

Comprising the ecological relations of fishes to their environment, types of habitats, etc.

For the association of fishes with hydroids, medusæ, etc.; see under Commensalism and symbiosis.

For marine fishes in freshwater and freshwater fishes in salt water, see Effects of changes in density and salinity under Physiology.

For upland or mountain-lake fauna, see under Distribution, vertical.

For the environmental conditions of certain ecological groups, see under such topics as Adaptation; Blind fishes of the caves; Deep-sea fishes; etc.

A selected bibliography of marine bionomics. Allen, E. J. 1911.1.

General treatises on the ecology of animals including fishes. — *Conditions of life in the sea*. ★Johnstone, J. 1908.1, 1911.2.

— *Life of inland waters*. ★Needham, J. G. & Lloyd, J. T. 1916.1. — *The natural conditions of existence as they affect animal life*. Semper, C. G. 1881.1, 1883.1. — *The relations between marine animal and vegetable life*. Vernon, H. M. 1898.1.

Bionomie des mers. Walther, J. K. 1893.1. — *Guide to the study of animal ecology*. ★Adams, C. C. Add. 1913.1. — *Animal communities in temperate America*. ★Shelford, V. E. Add. 1913.1.

Miscellaneous papers on the ecology of various fishes. Abbott, C. C. 1875.2; Baker, F. C. 1910.1; Bishop, W. L. 1908.1; Dickson, H. N. 1895.1; Eigenmann, C. H. 1894.2; Evermann, B. W. 1894.2; Fowler, H. W. 1906.2; Gracianov, V. I. 1904.2; Harting, P. 1877.4; N., P. 1880.1; Nichols, J. T. 1912.2; Weldon, W. F. 1894.1; ★Forbes, S. A. Add. 1914.1; Ward, H. B. Add. 1900.1; Richardson, R. Pre-Linn. 1714.1.

Special topics in Ecology

An ecological study of the fishes of a small stream. Hankinson, T. L. 1910.1.

Shallow sea fauna as affected by wave currents. Hunt, A. R. 1885.1.

Importance to the fisheries of the study of ecology. Miner, R. W. 1910.2.

Ecological succession, pond and stream fishes. Shelford, V. E. 1911.1–1912.1.

Ecology — Cont'd.

An index of fish environments. Shelford, V. E. & Allee, W. C. 1912.1.

Relations of currents, temperatures and other physical conditions of the sea. Watt, W. 1883.1.

A graphic method of correlating fish environment and distribution. Wright, A. H. 1907.1.

Dissolved gases in inland lakes as factors in the distribution of fishes. ★Birge, E. A. 1898.1, 1908.1, 1910.1; ★Birge, E. & Juday, C. 1911.1, Add. 1911.1; Juday, C. & Wagner, G. 1908.1; Knauthe, K. 1899.1.

Minimum oxygen content of water, necessary for maintenance of life. König, J. & Hünnekeier, B. 1901.1; Kupzis, J. 1901.1; Lebedintsev, A. A. 1908.2; Orsenigo, L. 1910.1; Paton, D. N. 1904.1.

For winter killing through lack of oxygen, etc., see under Mortality.

TYPES OF HABITATS

Fresh-water considered the habitat of the earliest vertebrates. Chamberlin, T. C. 1900.1; Pompeckj, J. F. 1914.1.

Artesian wells, the occurrence of fishes in artesian wells as shown by their occasional ejection.

Fishes in artesian wells in California. Chase, A. W. (Trout) 1874.1; Saxe, — 1870.1; Smith, R. (Gasterosteus) Add. 1884.1.

Fishes of the artesian wells of the Sahara. Blanc, E. 1895.1; Desor, P. J. 1864.1; Girard, C. F. 1889.3; Hult, R. 1895.1; Pellegrin, J. 1913.11, 1914.11; ★Rolland, G. F. 1881.1, 1895.1.

Indeterminable. Lataste, F. 1892.1; Lubach, D. 1875.2.

The only eyeless or blind fish which has been recorded from an artesian well is Trogloglanis pattersoni, a catfish from San Antonio, Texas, recorded by C. H. Eigenmann in Proc. Amer. Phil. Soc., 1919, vol. 58, pp. 397-400.

Hot Springs, or springs having a high temperature. Occurrence of fishes in hot springs in — Nevada. F., G. A. 1875.1. *Euganea, Italy.* Issel, R. 1901.1. — *Lower California.* Jordan, D. S. & Richardson, R. E. 1907.1. — *Pooree, Bengal.* M'Clelland, J. 1838.1. — *Misc.* Sonnerat, P. 1774.2.

Salt lakes, the occurrence of fresh-water fishes in the slowly dessicating remnants of fresh-water lakes. Salt lakes or lagoons near Tuggurth, Algeria. Günther, A. 1859.4; Tristram, H. B. 1859.1; Valenciennes, A. 1858.2. — *Lake Van, Turkey.* Deyrolle, T. 1871.1. — *Lake Urumiah, Persia.* Günther, A. 1899.3, Wilbraham, R. 1839.1. — *Salt lakes of central Asia.* Martens, E. 1879.1.

ELECTRICAL FISHES

General treatises, see especially Cisi-Halem, — 1901.1; ★Sihleanu, S. 1876.1.

— *Review of Sihleanu.* Joliet, L. Add. 1876.1.

Other general accounts. Berlin, K. 1866.1; Boll, F. 1874.3; Du Bois-Reymond, E. H. 1843.1; Dureau, A. 1868.1, 2; Humboldt, F. & Bonpland, A. 1806.2; Portier, P. 1906.1; Lemoine-Moreau, E. 1868.1; Wagner, R. 1848.1.

Historical: Galvani's discovery of electricity in Torpedo. Galvani, L. 1869.1; Gherardi, S. 1869.1.

Miscellaneous. Bird, J. 1875.1; Clarke, F. W. 1875.1; Corfield, H. 1888.1; Kammerer, P. 1906.1; Lubach, D. 1859.2; Murray, A. 1854.1; Nalepa, E. A. 1897.1; Noé, J. & Dissard, A. 1894.3; Panceri, P. 1859.1; Paterson, W. 1786.1; Richet, C. R. 1882.2; Rollett, A. 1872.1; Rudolphi, C. A. 1820.1; Sanderson, J. S. 1887.1; Scafati, G. 1875.1; Shufeldt, R. W. 1907.2; Stafford, W. 1897.1; Steffens, H. 1818.1; Anon. 100, 183, 258, 601; Beauregard, H. Add. 1884.1.

ELECTRICAL ORGANS

Chemical composition; in Raja and Torpedo. Baglioni, S. 1906.4; Schultze, M. J. 1861.1; Weyl, T. 1883.1, Add. 1883.1.

Development and embryology. Babukhin, A. I. 1870.1, 1882.2, 1883.2; ★Dahlgren, U. 1910.1; Gatti, M. A. 1899.1; Harting, P. 1877.5; ★Maurer, F. 1906.1.

Origin and development of electrical tissues in — Gymnarchus niloticus. ★Dahlgren, U. 1914.1. — *Raja batis.* ★Ewart, J. C. 1888.2, 1892.1. — *Torpedo.* ★Ogneff, J. F. 1897.1; ★Sanctis, L. 1873.1. — *Astrosopus.* Dahlgren, U. Add. 1914.3.

Histology and histogenesis. Schultze, M. J. 1857.1, 1859.2, 1860.2; ★Schultze, O. 1906.1, 2.

Histological structure of electrical organs of — Raja. ★Ballowitz, E. 1897.1. — *Gymnotus.* Ballowitz, E. 1897.2; Ciaccio, G. V. 1879.1; Knox, R. 1824.1; Pacini, F. 1852.1, 1853.1. — *Torpedo.* ★Ciaccio, G. V. 1874.1, 2, 1876.1, 2, 1877.1, 2, 3, 1882.1, 1897.1; Fauré-Fremiet, E. & Mironesco, T. 1911.1; Fritsch, G. T. 1889.1; ★Ivanov, N. 1894.1; Pacini, F. 1853.1; Ranvier, L. A. 1877.1; Wagner, R. 1847.3. — *Mormyrus.* Kupffer, C. W. 1857.1; Kupffer, C. W. & Keferstein, W. 1857.1, 1858.1; Schlichter, H. 1906.1.

Pseudo-electrical organs. Type of weaker discharge of Raja and Mormyrus, which see, below. — Development, etc. Babukhin, A. I. 1872.1, 1876.1; Gad, — 1877.1; Anon. 185, 508.

Functions, organs shown to be electrical. Robin, C. P. 1865.1, 2, 1879.1; Sanderson, J. & Gotch, F. 1888.1, 1889.1.

Constitution and Structure

General treatise. Jobert de Lamballe, A. J. 1858.1.

Other general accounts and researches. ★Babukhin, A. I. 1876.1; ★Garten, S. 1911.1; Geoffroy-St.-H., E. F. 1801.1,

1802.4,.5; Goodsir, J. 1855.1, 1868.2; Savi, P. 1844.1.

Miscellaneous papers. Gotch, F. 1892.1; Hartmann, R. 1861.1; Munk, H. 1858.1; Muskens, L. J. 1894.2; Riebesell, P. 1913.1; Knoepfel, R. Add. 1914.1; Redi, F. Pre-Linn. 1673.1. — *Analogous organ in Cetacea.* Knox, R. 1830.2.

Anatomy in various fishes. — *Astrosopus.* Dahlgren, U. 1906.1; Dahlgren, U. & Silvester, C. F. 1906.1.

Gymnotus (Electrophorus). ★Ballowitz, E. 1897.4, 1898.2; Chiaje, S. 1848.1; ★Du Bois-Reymond, E. H. 1881.1; ★Fritsch, G. T. 1881.1; Jobert de Lamballe, A. 1851.1; Letheby, H. 1843.1,.2; Sachs, Carl 1877.1, 1881.1.

In Steatogenys (Gymnotidae), the submental filaments are considered probable electric organs by Lowrey, A. Add. 1914.1.

For Electrical production, see below.

Malopterurus. (Organs supposed to arise from integument or modified glands.) Babukhin, A. I. 1875.1; ★Ballowitz, E. 1898.1, 1899.1; ★Bilharz, T. 1857.1; Boll, F. 1873.2; Fritsch, G. T. 1887.1. (*Review of Bilharz.*) Harting, P. 1857.2; Marcusen, J. 1854.1; Peters, W. C. 1844.2; Valenciennes, A. 1840.1.

For Electrical production, see below.

Mormyridæ. (*Pseudoelectrical organs.*) ★Marcusen, J. 1864.1; Ogneff, J. F. 1898.1.

Anatomy in — *Gymnarchus niloticus.* Erdl, M. P. 1847.3. — *Steatogenys.* Lowrey, A. Add. 1914.1.

Anatomy in Mormyrus. Ecker, A. 1855.1, 1858.1; ★Fritsch, G. T. 1891.1,.2; Harting, P. 1879.5; Kupffer, C. & Keferstein, W. 1858.1; Kölliker, R. A. 1849.1.

Raja. (*Pseudoelectrical organs.*) ★Ewart, J. C. 1888.1,.5, 1892.1, 1893.3; ★Ivanzov, N. 1895.1; Kölliker, R. A. 1857.6,.7; Macdonnell, R. 1861.1–1862.1; Mayer, A. F. 1843.1; Miescher, F. 1844.1; Retzius, A. J. 1845.1, 1848.1; Robin, C. P. 1846.3; 1847.1,.2; ★Sanderson, J. & Gotch, F. 1888.1; Schultze, M. J. 1858.1, 1861.1; Stark, James 1844.1; Wyman, J. 1859.5; Engelmann, T. W. Add. 1894.1.

Torpedo. Babukhin, A. I. 1882.1; Ballowitz, E. 1893.1; Boll, F. 1874.2, 1876.2; Cavalié, M. 1905.1; Ciaccio, G. V. 1876.1, 1877.1,.3; Fritsch, G. T. 1884.1, 1889.1, 1890.1; Girardi, M. 1786.1; Jobert de Lamballe, A. 1844.1, 1851.1; Meissner, G. & Billroth, T. 1852.1; Rouget, C. 1876.1, 1880.1; Savi, P. 1844.1; Ulrich, — 1851.1; Wyman, J. 1856.3; Zantedeschi, F. 1845.1.

For Electrical production, see below.

Nervous System of Electrical Fishes

Anatomy and histology. Crisafulli, E. 1901.2; Fritsch, G. T. 1884.3; Fuchs, S. 1894.1; ★Romano, A. Add. 1901.1.

Electrical nerves in — *Malopterurus.* Ecker, A. 1855.2; Harting, P. 1878.2; Kölliker, R. A. 1854.1. — *Mormyrus.* Stendell, W. 1915.1. — *Polarity in motor*

nerve cells of Tetronarce. Dahlgren, U. Add. 1914.4.

Effects of resection of electrical nerves. Garten, S. 1900.2; Krause, W. 1887.1.

Experiments on effects of curare, in Torpedo. Gotch, F. 1888.2; Moreau, F. A. 1860.1,.2; Schoenlein, K. 1895.3; Steiner, J. Add. 1875.1.

Development of nerves, chiefly in Torpedo. Ecker, A. 1849.1; Fritsch, G. T. 1892.1; Trinchese, S. 1892.1; Wagner, R. 1849.1.

Electrical center. *In spinal cord of Raiidæ.* Ewart, J. C. 1893.2; Dahlgren, U. Add. 1914.1.

Electrical center in Lobus electricus of medulla of Torpedo. *Anatomy and histology.* Fauré-Fremiet, E. & Mironesco, T. 1911.1; Fritsch, G. T. 1890.2; Harless, E. 1846.1; Hatai, S. 1901.1; Jonquière, G. 1879.1; Magini, B. 1894.1; ★Mencl, E. 1901.1, 1902.1, 1906.1, 1907.2; Paladino, G. 1909.1; Petelenz, J. 1886.1; Pighini, G. 1908.1; Reichenheim, M. 1873.1,.2, 1877.1; Rohon, J. V. 1878.1; Ramon y Cajal, S. 1888.1; ★Romano, A. 1899.1, 1902.2; Ruzicka, V. 1906.1; Solger, B. F. 1897.1,.2, 1902.1; Studnička, F. K. 1900.1. — *Nature of yellow color.* Romano, A. 1900.1. — *Perichromatin, a nuclear material.* 1902.1. — *Lobus electricus, development.* Schenk, S. L. 1877.1.

Nerve terminations in electrical organs. *Distribution, etc., chiefly in Torpedo.* A., C. 1858.1 (*Mormyridæ*); Ballowitz, E. 1898.3, 1899.2 (*Malopterurus*); Cavalié, M. 1904.4; ★Ciaccio, G. V. 1870.1, 1877.2,.3, 1883.1, Add. 1888.1; Crevatin, F. 1898.1; Ewald, A. 1881.1; Fritsch, G. T. 1893.1; Kölliker, R. A. 1856.1; ★Krause, W. 1886.1, 1891.1; Pighini, G. 1908.1; ★Poloumordwinoff, D. 1902.1; Ranvier, L. A. 1872.1, 1875.1; Remak, R. 1856.1; Retzius, M. G. 1898.2 (*Raja*); Rouget, C. 1865.1, 1876.2; Savi, P. 1841.1, 1844.1; Wagner, R. 1847.1,.4.

PHYSIOLOGY AND FUNCTIONS

Production of Electricity

General treatises. ★Garten, S. 1910.1; Matteucci, C. 1844.1; Valentin, —. 1842.1; ★Biedermann, W. Add. 1895.1.

Researches dealing with the subject as a whole. Babukhin, A. I. 1876.1; Du Bois-Reymond, E. H. 1848.1, 1850.1, 1853.1, 1865.1; Fritsch, G. T. 1891.1,.2; Helmholtz, W. 1853.1; Pacini, F. 1846.1–1853.1; Volta, A. 1797.1, 1801.1; Gotch, F. Add. 1900.1.

Historical accounts, development of our knowledge and ideas of the ancients. Keferstein, W. M. 1859.1; Pouchet, G. 1879.2; Du Bois-Reymond, E. H. Add. 1843.1.

Effect of electrical discharge. — *Electrolysis of salts.* Du Bois-Reymond, E. H. 1862.1. — *Narcosis produced.* Engelen, — 1912.1. — *Comparison with Voltaic pile and thermoelectric pile.* Pacini, F. 1852.1, 1853.1.

Source of electricity. Delarive, A. 1871.2

Electrical Fishes — Cont'd.

Matteucci, C. 1847.2,3; Moreau, F. A. 1860.2,4; Anon. 626.

Construction of successful working models of electrical fishes. Baur, E. 1913.1; Cavendish, H. 1776.1.

Alleged electrical power of Silurus glanis. Vouga, C. 1866.1.

Electrical production; Gymnotus.

Functions of electrical organs, etc. Allamand, J. N. 1776.1; Bajon, — 1774.1, 1779.1; Faraday, M. 1839.1; Gronovius, L. T. 1760.1; ★Humboldt, F. H. & Bonpland, A. J. 1805.1, 1820.1; Leroy, J. B. 1776.1; Letheby, H. 1843.1,2; Marey, E. J. 1879.1,2; Miranda, D. & Puci, G. M. 1845.1,2; ★Sachs, C. 1877.1,2, 1881.1; Schönbein, C. F. 1841.1,2,3; Termeyer, R. M. 1781.1; Williamson, H. 1775.1; Delius, H. F. Pre-Linn. 1752.1.

Medical properties. Lott, F. 1762.1. — *Employment as medical shock-machine by natives of Surinam.* Wilson, G. 1857.1, 1860.1.

For Anatomy of electrical organs, see above.

Malopterurus. Broussonet, P. M. 1782.2; Cremer, M. 1912.1; Du Bois-Reymond, E. 1881.2, 1882.1, 1891.1; Gotch, F. 1899.1, Add. 1886.1, 1895.1; ★Gotch, F. & Burch, G. J. 1896.1, 1897.1, 1900.1; ★Koike, I. 1910.1; Logeman, W. M. 1863.1. — *Periodical activity of spinal ganglion cells of Malopterurus in electric discharge.* Garten, S. 1910.2. — *Using electric power to obtain food.* Stirling, A. B. 1878.2.

Torpedo. *For Anatomy of electrical organs, see above.*

General researches on electrical functions. Cremer, M. 1909.1; ★Davy, J. 1829.1, 1832.1, 1834.1, Add. 1835.1; Du Bois-Reymond, E. H. 1888.1, 1893.1, Add. 1889.1; Eckhard, C. 1858.1; Fuchs, R. F. 1900.1; ★Garten, S. 1900.1, Add. 1900.1; ★Gotch, F. 1888.1, 1889.1, Add. 1887.1–1888.2; Linari, S. 1832.1–1839.1; Lemoine-Moreau, E. 1868.1; ★Matteucci, C. 1836.1–1862.1; Pringle, J. 1775.1,2, 1779.1, Add. 1783.1; Schoenlein, K. 1895.2, Add. 1896.1; Spallanzani, L. 1783.1,2,3; Volta, A. 1807.1; Walsh, J. 1774.2; Zantedeschi, F. 1841.1–1852.1.

Effects of electrical discharge. — *On marine animals.* Carazzi, D. 1897.1. — *In formation of urea.* Gréhant, L. F. & Jolyet, F. 1891.1. — *Discharge in fresh water.* Kreidl, A. & Kinoshita, T. 1910.1. — *Intensity and duration.* Delarive, A. 1871.1; Marey, E. J. 1871.1–1879.1. — *Immunity of Torpedo to its own shock.* Jobert, C. & Jolyet, F. 1895.1; Steiner, J. 1874.1; Anon. 561.

Thermo-dynamics of discharge. ★Bernstein, J. & Tschermak, A. 1904.1, 1906.1. — *Chemical interchanges.* Marcuse, W. 1891.1; Röhmman, F. 1893.1; Weyl, T. 1881.1–1883.1, Add. 1883.1. — *Transformation of forces.* Rouget, C. 1879.1.

Medical use of the shock. Frenzel, J. S.

Add. 1777.1; Kaempfer, E. Pre-Linn. 1694.1.

Researches with oscillograph on isolated electric organ of Astrape. ★Fuji, K. Add. 1914.1.

Miscellaneous papers. Arsonval, A. 1895.1; Becquerel, A. C. 1837.1, 1862.1; Breschet, G. & Becquerel, A. C. 1835.1, 1836.1; Couch, J. 1823.1; François-Franck, C. A. 1879.1; Gay-Lussac, L. J. & Humboldt, A. 1805.1; Home, E. 1816.2; Ingenhousz, J. 1775.1; Jolyet, F. 1883.1; Jolyet, F. & Rivière, P. 1895.1; Leroy, J. B., Walsh, J. & Seignette, — 1774.1; R., A. de L. 1862.1; Schilling, G. W. 1808.1; Soave, F. 1781.1; Stassano, H. 1883.1; Todd, J. T. 1816.1, 1817.1; Vada, H. 1862.1; Vassalli-Eandi, A. M. 1799.1; Eisig, H. Add. 1883.1.

Pre-Linn. references. Cramer, A. 1710.1; Kircher, A. 1643.1–1678.2; Réaumur, R. A. 1741.1. — *Important researches.* Lorenzini, S. 1678.1; Redi, F. 1671.1.

EMBRYOLOGY OF FISHES

Comprising the developmental stages subsequent to the fertilization of the ovum.

The various divisions and sub-divisions of this subject are so closely interrelated that there should be constant cross reference from one division to related ones. In some cases such cross references are noted herein.

For earlier stages of development, i. e. those preceding fertilization, see Oogenesis and maturation under Ova and Ovum.

For later stages of development, see Larvæ under Planktonic fauna.

For the development of individual types, see under the various genera, families, and higher groups.

For the development of particular organs, and systems, see under such topics as Air bladder; Electrical organs; Eye; Head; Heart; Pancreas; Urino-genital system, etc.

For the development, not primarily embryological, of viviparous fishes see Viviparity under Reproduction.

For the metameric arrangement of embryological structures, particularly of the central nervous system and mesoderm, see under Metamerism.

For methods of study in embryology see under Technique and Methods of Study.

General treatises

General treatises on the comparative embryology of vertebrates, including fishes.

Text in English. Balfour, F. M. 1880.1; Beard, J. 1896.2; Foster, M. & Balfour, F. M. 1874.1, 1883.1; ★Kellicott, W. E. 1913.1,2; McMurrich, J. P. 1913.1; Marshall, A. M. 1893.1; Agassiz, J. L. Add. 1849.1.

Text in French. Houssay, F. 1893.1.

Text in German. ★Hertwig, W. A. 1888.1, 1906.2, 1910.1; Levy, O. 1913.1; ★Oppel, A. 1891.1, Add. 1914.1; Rathke, M. H. 1861.1; Schenk, S. L. 1874.3; Schneider, A. F. 1879.1; Treviranus, G. R. 1828.1; ★Ziegler, H. E. 1902.1.

Text in Russian. Mitrofanov, P. I. 1892.3.

For the most recent and valuable treatise in English on vertebrate embryology (mammalia excepted), see ★Kerr, J. G. Text-

book of Embryology. Vol. II, Vertebrata. London, 1919. 591 p.

For a bibliography of vertebrate embryology prior to 1893, see Minot, C. S. Add. 1893.1.

VARIOUS TOPICS

In aquarium at Hamburg, eggs of *Scylium canicula* hatch in from eight to nine months, *S. catulus* in five or six months. Bolau, C. C. 1881.1. — Eggs of dogfish (*Squalus*), kept in tidal pool at Concarneau, hatch in nine months after laying. Coste, J. J. 1867.1.

The bearing of the embryology of the lower fishes on vertebrate morphology. Kerr, J. G. 1906.1.

Softening of egg membranes by digestive ferment at time of hatching. Kerr, J. G. 1901.1; Wintrebert, P. 1912.1, 2. — Hatching of ovum as an osmotic phenomenon. Philippson, M. 1912.1.

Weight of developing eggs. Ritter, W. E. & Bailey, S. E. 1908.1.

Miscellaneous and general papers on embryology. Baer, K. E. 1829.1, 1836.3; Balfour, F. M. 1875.1; Beard, J. 1896.2, 1897.1; Budgett, J. S. 1901.1; Conklin, E. G. 1905.1; Filippi, F. 1841.1, 1845.2, 1846.1, 1847.1, 2; Gaskell, W. H. 1898.1 (xii); Goette, A. 1869.1; Janosik, J. 1883.2; Kölliker, R. A. 1850.1; Kollmann, J. 1885.1; Lanzi, L. 1908.1; Lebert, H. 1845.1; Minot, C. S. 1901.2; Pouchet, G. 1872.4; Ryder, J. A. 1882.9, 1883.1; Sedgwick, A. 1910.1; Sundevall, C. J. 1851.2, 1852.1, 1855.1; Valentin, G. G. 1850.1; Vogt, C. C. 1842.2.

Experimental Embryology

Polyembryony (experimental). Bataillon, E. 1900.3. — Blastodisks of rays cut in fragments fuse to form new disks. Eismond, J. 1910.1, 2. — Number of cells in larvae from isolated blastomeres, *Amphioxus*. Morgan, T. H. 1896.1.

Immunity of *Fundulus* eggs to electrical stimulation. Brown, O. H. 1903.1. — Centrifuging, effects on development of eggs. Stein, S. T. 1909.1.

Changes in chemical energy in developing eggs. Glaser, O. C. 1912.1, 2, 3. — Differences of electrical potential in developing eggs. Hyde, I. H. 1905.1. — Chemical changes in developing egg. Levene, P. A. 1901.1.

Colored lights, influence on development, *Gadus* and trout. Grein, H. 1914.1; Supino, F. 1910.2. — Sunlight, harmful influence to eggs. Millet, C. 1855.2; Page, W. F. 1885.1.

Effects or influence on developing (fish) eggs of — Alkaloids. McClendon, J. F. 1912.2. — Alcohol and lithium chloride. Stockard, C. R. 1906.1, 1907.3, 1909.3, 1910.4. — Radium. Tur, J. 1906.1–1913.1. — Oxygen deficiency. Loeb, J. Add. 1893.1, 1896.1.

Resistance of ova to mechanical injury. Steuert, L. 1905.1. — Experimental studies (with cautery). Sumner, F. B. 1903.1, 1904.2.

Influence of temperature on rate of development. Johansen, A. C. & Krogh, A. Add. 1914.1; Krogh, A. Add. 1914.1.

For related topics, see Experimental researches under Physiology, and later in this section, Germ ring under Gastrulation.

For the artificial production of monstrosities, see under Experimental results, and Cyclopia under Teratology.

Origin and migration of germ cells

Including "segregation of germ cells."

Papers recording this process in — *Amia* and *Lepidosteus*. ★Allen, B. M. 1911.1. — *Pristiurus*, *Raja*, etc. Beard, J. 1901.1–1904.1, Add. 1902.1. — *Lophius*. Dodds, G. S. 1910.1. — *Embiotocidæ*. Eigenmann, C. H. 1891.1, 4, 1896.1, 3. — *Salmo*. Federow, V. 1907.1. — *Opsanus*. Sink, E. W. 1912.1. — *Squalus*. Woods, F. A. 1902.1. — *Amiurus*. Bachmann, F. M. Add. 1914.1. — General article. ★Waldeyer, W. Add. 1901.1.

For Oögenesis and maturation of ovum, see under Ova and Ovum.

Parthenogenesis

The subject of parthenogenesis in vertebrates has been fully reviewed by ★R. Bonnet in *Ergebnisse der Anat. u. Entwicklungsgeschichte* (Anat. Hefte), 1899, Band ix, 820–870.

While in vertebrates parthenogenesis does not occur naturally, the cleavage of unfertilized eggs in the ovaries of fishes has been reported in — Cod. Burnett, W. J. in *Proc. Amer. Acad. Arts & Sci.*, 1857, vol. iii, p. 44. — Trout. Oellacher, J. 1872.1 (p. 405). — Pickerel. Sturtevant, E. L. 1877.1. — Remarks on this. Brooks, W. K. 1877.1.

Such intra-ovarian segmentation was noticed in cod, hake, haddock and whiting, and thought to indicate viviparity. Agassiz, J. L. 1856.11.

Eggs of *Amphioxus* show a tendency to divide if not fertilized. Stricht, O. 1896.1.

The only researches known to us on fishes, wherein artificial parthenogenesis has been induced by chemicals, are those of Bataillon, E. 1900.6, 1903.1, 1904.1.

Sex-determination in fishes

"The sex-chromosome formula has not been definitely established, either cytologically or genetically."

"There is some evidence, however, that they are of the type, female XX, male XY," through the researches on hybrid viviparous *Pæciliidæ* of Gerschler, W. M. Add. 1914.2.

For confirmatory results and a genetical analysis, see ★J. S. Huxley in *Journal of Genetics*, 1920, vol. 10, pp. 265–276.

For a further discussion bearing on this subject, see under Sex-ratio.

In the *Pæciliid* *Lebistes*, O. Winge (*Journ. Genetics*, 1922, 12, pp. 145–162) has demonstrated cytologically the XX, Xy condition.

From his studies on the germ cells of *Raja* and *Pristiurus*, Beard concluded that sex is pre-determined in the egg and that

Embryology — Cont'd.

the sperm can have no influence. Beard, J. 1902.1-1904.1.

EARLY STAGES
in development

The following papers deal collectively with early stages of development, fertilization, cleavage, invagination, etc., in the following groups. The separate phases of development will be found below under the various headings. In general these papers do not treat of the subject beyond the formation of the embryo.

For papers dealing with the whole developmental history of the fishes named, see the final sub-section, Embryology and development of various fishes, below.

Early stages of development in Amphioxus. MacBride, E. W. 1898.1, 1900.1.

Early stages in Petromyzon. McClure, C. F. 1893.1.

Early development in Elasmobranchii. Dean, B. 1901.1; Eigenmann, C. H. & R. S. 1889.11.

Early stages of development in — Ganoidae generally. Dean, B. 1896.4. — *Amia.* ★Dean, B. 1895.2, 6; Lanzi, L. 1909.2. — *Lepidosteus.* Beard, J. 1889.3; ★Dean, B. 1895.3, 6; Lanzi, L. 1909.2. — *Acipenser.* ★Dean, B. 1895.3, 6.

Early stages in Teleostei generally. Agassiz, A. 1883.1; Aubert, H. 1853.1, 1854.1; Bambeke, C. 1876.1; Browne, F. B. 1907.1; Cunningham, J. T. 1891.5; ★Hoffmann, C. K. 1880.1, 1881.1, 1883.2; Kovalevski, M. 1886.2; Lanzi, L. 1909.3; Meek, A. 1913.2; Prince, E. E. 1886.1.

Early stages in certain Teleosts. — Trachinus. Boeke, J. 1903.4. — *Perca.* Derjugin, K. M. 1901.1. — *Perca and Cyprinus.* Rusconi, M. 1835.3, 1836.2, 3. — *Cymatogaster.* Eigenmann, C. H. 1892.3. — *Salmonidae.* Klein, E. E. 1872.2, 1876.1; Oellacher, J. 1873.3, 1879.1; Ovsyannikov, F. V. 1874.1. — *Lebias.* Mazza, F. 1902.1. — *Clupea.* Dixon, B. I. 1913.1; Kupffer, C. W. 1878.1; Pouchet, G. & Biérix, E. 1889.1, 2. — *Liparis.* Platner, G. 1888.1. — *Noturus.* Sumner, F. B. 1899.1. — *Esox.* Truman, E. B. 1869.1. — *Serranus.* ★Wilson, H. V. 1891.1.

Streaming of protoplasm

Descriptions of the streaming of the protoplasm to form the germinal disk in Teleostei. Coste, P. 1850.1; Gerbe, Z. 1875.1; Henneguy, L. F. 1881.1; Pouchet, G. & Biérix, E. 1889.1.

For other references to the streaming of the protoplasm, see under Fertilization, and under Segmentation.

FERTILIZATION

General accounts of the fertilization of the ovum. Blanchard, R. 1879.1; ★Hertwig, C. W. 1903.1; ★Rabl, C. 1915.1.

Miscellaneous items, comprising notes, observations, etc. Anderson, J. 1800.1; Bastard, — 1812.1; Bell, C. 1874.1; Küchenmeister, G. F. 1866.1; Kupffer, C. W. 1877.1; Ransom, W. H. 1855.1; Schücking, A. 1904.1.

Fertilization. — Early effects. Bambeke, C. 1872.1. — *Affecting temperature of water containing the eggs.* Coleman, N. 1872.1; Hartshorne, H. 1872.1. — *Causing decrease in size of ovum, Lampetra.* Okkelberg, P. 1914.2.

Sperm extracts (salmon), effect upon ova. Cremer, M. 1900.1. — *Fertilization with sperm contained in alcohol.* Lebedintsev, A. A. & Nedšoivin, A. 1912.1. — *Effects of radium treated spermatozoa.* Oppermann, K. 1913.1.

Centrosome, role in fertilization. Czer-mák, N. 1903.1. — *Rotation of yolk after fertilization, Esox.* Reichert, C. B. 1856.2. — *Polyspermy.* ★Rückert, J. 1910.1, Add. 1892.2.

Fertilization of the egg of Amphioxus. Panceri, P. 1867.2; ★Sobotta, J. 1897.2, Add. 1895.1; Stricht, O. 1896.1.

Fertilization of ovum of Cyclostomata (Petromyzon). Böhm, A. A. 1887.1, 1888.1; Calberla, E. 1877.1; Herfort, K. V. 1899.1, 1900.1; Kupffer, C. W. & Benecke, B. 1878.1; Müller, A. 1864.1.

Fertilization of the egg of — Selachii. Rückert, J. 1891.1, Add. 1891.1. — *Acipenser.* Zaleniskii, V. V. 1878.1.

Fertilization of eggs of Teleostei. ★Agassiz, A. & Whitman, C. O. 1885.1, 2, 1891.1. — *Clupea.* Arnold, J. N. 1906.1; Ewart, J. C. 1884.3. — *Clinus.* Gintel, F. 1892.1. — *Gasterosteus.* Ransom, W. H. 1854.1. — *Eels.* Syrski, S. 1875.2, 1876.1. — *Pomotis.* Wyman, J. Add. 1863.1.

Fertilization in Salmonidae. ★Behrens, G. 1898.1; Blanc, H. 1891.1, 1892.1, 1894.1, 1898.1, 2, 3; Böhm, A. A. 1891.1; Davy, J. 1854.1; Kupffer, C. W. 1886.1; Oellacher, J. 1873.2.

For Cross-fertilization experiments, i. e. fertilization of ova with sperm of remotely related species, see under Hybrids and hybridization.

Many embryologists have artificially fertilized fish ova during their studies. Such efforts are recounted in many of the foregoing papers. The following references especially refer to artificial fertilization in these forms. — *Prototroctes.* Allport, M. 1869.3. — *Goldfish.* Berkhouse, J. R. 1909.1. — *Cantharus.* Künstler, J. 1893.1. — *Cristiceps.* Kopsch, F. 1902.2.

For Methods of artificial fertilization used in fish culture, see that subject in section on Pisciculture.

CLEAVAGE OR SEGMENTATION

For a general treatise on the cleavage of the ovum, see ★Sobotta, J. Add. 1897.1.

Alternation of periods of rest with periods of activity in segmentation (Batrachus). Brooks, W. K. 1883.1.

Relation of first cleavage plane to the future embryonic axis. Bataillon, E.

1896.4; Cerfontaine, P. 1905.2; Clapp, C. M. 1898.1; Rauber, A. 1883.1.

Symmetry of first segmentation furrows of blastodisk, elasmobranchs. Ryder, J. A. 1886.9.

Miscellaneous and general accounts on the cleavage of the ovum. Aubert, H. 1853.1; Bambeke, C. 1872.1-1876.1; Coste, P. 1850.2; Ecker, A. 1852.1; Lereboullet, D. A. 1864.1,3; Newman, H. H. 1910.1, 1914.1; Norman, W. W. 1896.1; Oellacher, J. 1875.1; Rauber, A. 1883.2; Sanzo, L. 1915.2 (i).

Holoblastic cleavage

Holoblastic or complete cleavage of the ovum. *In Cyclostomata (Petromyzon).* Calberla, E. 1877.1; Glaesner, L. 1910.2; Herfort, K. V. 1899.1; McClure, C. F. 1893.1; Rauber, A. 1883.1.

Holoblastic cleavage in Ganoidei. — *Acipenser.* ★Dean, B. 1895.3,6; Peltz, E. D. 1887.1; Zalenskiĭ, V. V. 1878.1. — *Amia.* ★Dean, B. 1895.2; Virchow, H. 1896.1,2; ★Whitman, C. O. & Eycleshymer, A. C. 1897.1. — *Lepidosteus.* ★Dean, B. 1895.3,6; Eycleshymer, A. C. 1899.1, 1903.1. — *Polypterus.* Kerr, J. G. 1907.2.

Holoblastic segmentation of eggs of Dipnoi. — *Protopterus.* Budgett, J. S. 1900.5. — *Lepidosiren.* Kerr, J. G. 1900.1. — *Neoceratodus.* Semon, R. W. 1901.2.

Meroblastic cleavage

Meroblastic or partial segmentation. *In eggs of Elasmobranchii, taking place during their descent through the oviduct.* Coste, P. 1847.1; Gegenbaur, C. 1861.1; Gerbe, Z. 1872.2,3; Kollmann, J. 1886.2; ★Rückert, J. 1899.1; Ryder, J. A. 1887.1; Kastchenko, N. Add. 1894.2.

Meroblastic segmentation in Chimæra. ★Dean, B. 1906.1.

Reminiscence of holoblastic cleavage in Cestracion. Dean, B. 1901.5.

Meroblastic segmentation of eggs of Teleostei. General papers. ★Agassiz, A. & Whitman, C. O. 1885.1 (ii),2, 1891.1; Bataillon, E. 1896.3; Beneden, E. 1877.1; ★Fusari, R. 1887.2, 1892.1, 1895.1; Janosik, J. 1883.1, 1885.2; Köhler, R. & Bataillon, E. 1893.2; Meek, A. 1913.2; Rudnev, V. G. 1899.2; Kovalevski, M. Add. 1885.1.

Partial segmentation in eggs of certain Teleosts. — *Perca.* Derjugin, K. M. 1901.1. — *Siphostoma.* Gudger, E. W. 1905.1. — *Salmo.* Kopsch, F. 1911.1; Ryder, J. A. 1882.7. — *Belone.* Kopsch, F. 1901.1. — *Lebias.* Mazza, F. 1902.1. — *Brook trout.* Oellacher, J. 1872.1. — *Gadus and Motella.* Haeckel, E. Add. 1875.1.

Periblast

Also known as "Dotterorgan," "merocytes," and "yolk-syncytium." It should not be confused with the "yolk-nucleus or vitelline body," which is to be found under Ovarian ovum under Ova and ovum.

For a general treatise on the structure, development and derivatives of the periblast, see ★His, W. Add. 1900.1.

General researches on the origin, structure, and development of the periblast. Filippi, F. 1860.1; ★Hoffmann, C. K. 1888.1; ★Raffaele, F. 1899.1; Vejdovský, F. & Mrázek, A. 1898.1; ★Virchow, H. 1892.1, Add. 1897.1; Henneguy, L. F. Add. 1882.2.

Structure, development, etc., in Elasmobranchii. Eismond, O. P. 1898.1; His, W. 1897.1; Rückert, J. 1885.1, Add. 1890.1. — *Scyllium.* Beard, J. 1896.5; Eismond, J. 1903.1. — *Comparative differences in formation in various Selachii.* Virchow, H. 1897.2. — *In Chimæra.* Dean, B. 1906.1.

Periblast of Teleostei, structure, etc. Bataillon, E. 1896.1, 1900.1; Berent, W. 1896.1; Brook, G. 1887.3; Corning, H. K. 1896.1; ★Kopsch, F. 1902.1; Reinhard, W. 1898.1,2, 1899.1; Wenckebach, K. F. 1886.1; Ziegler, H. E. 1894.1, 1896.1; Golovine, E. Add. 1891.1.

Periblast in certain Teleosts and in Lepidosteus. — *Esox.* Berg, L. S. 1899.2. — *Belone.* ★Kopsch, F. 1901.1. — *Labridæ.* List, J. H. 1887.4. — *Salmonidæ.* Rieneck, — 1869.1; Virchow, H. 1894.2, 1895.1. — *Lepidosteus.* Beard, J. 1896.5.

For other papers containing references to the periblast, see under Cleavage and also under Early stages.

GASTRULATION

formation of gastrula

For general treatises on gastrulation in fishes, see ★Kopsch, F. 1904.1, and ★Keibel, F. Add. 1900.1.

Gastrulation in Amphioxus. Klaatsch, H. 1897.1, 1898.1; MacBride, E. W. 1908.1; ★Morgan, T. H. & Hazen, A. P. 1900.1; ★Sobotta, J. 1897.1.

In Cyclostomata (Petromyzon). ★Glaesner, L. 1910.1,2; ★Hatta, S. 1907.1; Selys-Longchamps, M. 1910.1. — *In Bdellostoma.* ★Dean, B. 1899.6.

Gastrulation in Ganoidei and Neoceratodus. — *Amia.* Brachet, A. 1912.1; Eycleshymer, A. C. & Wilson, J. M. 1906.1; Sobotta, J. 1896.1. — *Acipenser and Lepidosteus.* ★Dean, B. 1895.3,6. — *Neoceratodus.* Semon, R. W. 1901.2.

Gastrulation in Teleostei in general. Boeke, J. 1907.2; ★Corning, H. K. 1896.1; Dean, B. 1895.7; Henneguy, L. F. 1880.1; Kovalevski, M. 1886.1; Sobotta, J. 1898.1; Sumner, F. B. 1900.2; Ziegler, H. E. 1887.2.

Gastrulation in certain Teleosts. — *Coregoninæ.* Auerbach, M. 1904.1. — *Muraenidæ.* Boeke, J. 1903.1. — *Salmon.* Goette, A. 1873.1. — *Gadus and Motella.* Haeckel, E. Add. 1875.1.

Specific researches on various problems in gastrulation. — *Gastrulation in meroblastic ova.* Kupffer, C. W. 1884.1. — *Influence of yolk on gastrulation in Teleosts.* Cunningham, J. T. 1885.2. — *In Selachii and Teleostei.* Samassa, P. 1896.1.

Embryology — Cont'd.

— *Gastrulation in double embryos of trout.* Schmitt, F. 1902.1.

Blastopore

The primitive opening into the archenteron formed by gastrulation.

Relation to primitive streak. Bellonci, G. 1884.1. — *Asyntaxis, Amphioxus.* Legros, R. 1907.1. — *Blastopore of Selachians.* Ostroumov, A. A. 1889.1.

Prostomial thickening of dorsal lip of blastopore, Ganoids and Teleosts. Lanzi, L. 1909.2,3.

Yolk blastopore, position determined by size of vitellus. Ryder, J. A. 1885.12. — *Persistence of blastopore in Petromyzon.* Shipley, A. E. 1886.2, 1887.1.

Germ ring

Structure and development in — Teleostei. Corning, H. K. 1896.1. — *Batrachus.* Wallace, L. B. 1899.1.

Experimental researches on development, Salmonidæ. Kopsch, F. 1896.2. — *Experiments on localization and regeneration in Fundulus.* Lewis, W. H. 1912.1,2.

Germ layers**Origin and development**

General treatises. Assaky, G. 1886.1; ★Hertwig, W. A. Add. 1903.1; ★Keibel, F. Add. 1900.1.

Miscellaneous and general papers. Hertwig, W. A. 1901.1; Lvov, V. N. 1893.1,3, 1894.1; Nicolucci, G. 1844.1; Perenyi, J. 1889.1; Samassa, P. 1895.1.

Formation of the germ layers in the lower fishes and in Neoceratodus. — Petromyzon. Hatta, S. 1892.1; Selys-Longchamps, M. 1910.1. — *Amphioxus.* MacBride, E. W. 1896.1, 1908.1, 1909.1. — *Selachii.* Rückert, J. 1885.1, 1889.1; Swaen, A. 1885.1. — *Neoceratodus.* Semon, R. W. 1901.2.

Development of germ layers in Teleostei generally. ★Berent, W. 1896.1; Brook, G. 1887.1; Lanzi, L. 1909.1, 1910.1; Moquin-Tandon, G. 1875.1; ★Swaen, A. & Brachet, A. 1902.1, 1904.1; Kovalevski, M. Add. 1885.1; Sumner, F. B. Add. 1899.1.

Formation of germ layers in certain Teleostei. — Murænidæ. ★Boeke, J. 1903.1. — *Salmonidæ.* ★Goronowitsch, N. 1885.1; Henneguy, L. F. 1882.1; Ovsyannikov, F. V. 1874.1. — *Cyprinidæ.* Reinhard, W. 1888.1.

Researches on specific problems relating to the germ layers. — Origin and significance of the germ layers. Lankester, E. R. 1873.3, 1877.1. — *Influence of yolk on development of germ layers.* Samassa, P. 1896.1. — *Development in terminal bourgeon and in tail of Teleosts.* Swaen, A. & Brachet, A. 1902.1, 1904.1.

For the part of the germ layers in the "Origin of pronephric duct," see this heading under Urinogenital System.

ECTODERM OR EPIBLAST

Limit in mouth. Johnston, J. B. 1909.2. — *Organs, derived from.* Kupffer, C. W.

1895.1. — *Relation to development of mesenchyme.* Lundborg, H. 1899.1.

ENTODERM OR ENTOBLAST

Development in Murænoids. Boeke, J. 1902.1. — *Entoderm of digestive system, origin in Amia.* Brachet, A. 1912.1. — *Origin in Teleosts.* Brook, G. 1885.8. — *Derivatives from.* Hoffmann, C. K. 1892.1, 1893.2. — *Limit in mouth.* Johnston, J. B. 1909.2.

Yolk-sac entoderm, development. Kopsch, F. 1901.1, 1902.1, 1911.1; His, W. Add. 1900.1. — *"Secondary entoderm" of teleosts.* Gensch, H. Add. 1882.1.

MESODERM OR MESOBLAST

For a general treatise on the origin of the mesoderm and on the organs derived from it, see ★Rabl, C. Add. 1889.1 and 1897.1.

Miscellaneous and general papers on the origin and development of the mesoderm. Lvov, V. N. 1894.1; Minot, C. S. 1890.2; Perenyi, J. 1891.1.

Development of the mesoderm in Amphioxus and Petromyzon. — Amphioxus. ★Garbowski, T. 1898.1; Sarasin, P. 1889.1. — *Petromyzon.* Shipley, A. E. 1886.2.

Development of the mesoderm in Elasmobranchii. Balfour, F. M. 1877.1; Hertwig, W. A. 1883.1; Hoffmann, C. K. 1883.1; Rückert, J. 1887.1; Virchow, H. 1898.2; Wijhe, J. W. 1882.2, 1889.1.

Development of mesoderm in Teleostei. Boeke, J. 1903.2; Borcéa, J. 1909.2. — *Murænidæ.* Boeke, J. 1902.1, 1903.1. — *Salmonidæ.* Sobotta, J. 1894.1; Henneguy, L. F. Add. 1882.1.

Development of the head mesoblast in Dipnoi and Ganoidei. — Head mesoblast in Dipnoi. Agar, W. E. 1907.1. — *Neoceratodus.* Gregory, E. H. 1905.1; Greil, A. 1907.1. — *Head mesoblast, Amia.* Reighard, J. E. & Phelps, J. 1908.1.

Development of the head mesoblast in Torpedo and Pristiurus. Emmert, J. 1900.1.

Mesoblast as an organ anlage. Borcéa, J. 1909.2; Schenk, S. L. 1868.1; Swaen, A. & Brachet, A. 1899.1,2. — *Share in formation of pectoral fin in Teleostei.* Boyer, E. R. 1892.1. — *Gastral mesoderm doubtfully existent.* Raffaele, F. 1901.1.

MESENCHYME

Mesoblastic tissue derived mainly from the mesoderm, but also in small part from the entoderm.

Origin and development. ★His, W. Add. 1900.1. — *Acipenser.* Tichenko, S. 1906.1. — *Selachii.* Ziegler, H. E. 1891.1. — *A source of connective tissue.* Kollmann, J. 1883.1, 1884.1; Szily, A. 1908.1.

EMBRYO FORMATION

General treatises. His, W. 1894.3; ★Kopsch, F. 1904.1; Morgan, T. H. 1895.1; Keibel, F. Add. 1902.1.

Miscellaneous. Brachet, A. 1905.1; Kœhler, R. & Bataillon, E. 1893.2; Kastchenko, N. Add. 1894.1.

Embryo formation in — Elasmobranchii. His, W. 1877.1,2; Schultz, A. 1875.1,2. — *Amia.* Eycleshymer, A. C. & Wilson, J. M. 1906.1. — *Acipenser.* Zalenskiĭ, V. V. 1879.1.

Embryo formation in Teleostei. Henneguy, L. F. 1887.1; Kupffer, C. W. 1867.1; Reis, K. 1911.1. — *Embryonic anlage, Salmonids.* Auerbach, M. 1904.1; Goronowitch, N. 1885.1.

Development of organs in Pristiurus, Torpedo, Herring, and Trout. Oppel, A. 1891.1. — *Gadus.* Ryder, J. A. 1884.3. — *Acipenser.* Zalenskiĭ, V. V. 1879.1.

Neurenteric canal and neuropore, structure and development. Kopsch, F. 1896.1; Kupffer, C. W. 1887.1; Stendell, W. 1914.1. — *Phylogeny of neuropore.* Ayres, H. Add. 1907.1.

Primitive streak, the region on either side of the primitive groove which is formed by the concrescence of the lips of the blastopore. — *In Gymnarchus.* Assheton, R. 1907.2. — *Development.* Bellonci, G. 1884.1; Kupffer, C. W. 1884.1. — *In Teleosts.* Henneguy, L. F. 1885.1, Add. 1884.1. — *In meroblastic ova.* Kollmann, J. 1886.1. — *In Scyllium.* Kopsch, F. 1898.2.

For the segmental structure of the developing head, see Metamerism under Head.

CONCRESCENCE THEORY

Theory of the formation of the fish embryo, by the growing together of the lips of the germ ring.

Disproved by experiments. Morgan, T. H. 1893.1. — *Concrescence theory with reference to gastrulation of double embryos.* Schmitt, F. 1902.1.

Notes, remarks, and researches on the concrescence theory. Eycleshymer, A. C. 1902.1; Glaesner, L. 1910.1; Minot, C. S. 1890.1; Ryder, J. A. 1885.9; Whitman, C. O. 1878.1; ★Virchow, H. Add. 1897.1.

Kupffer's vesicle

A remnant of the archenteron, found in Teleostei and (doubtfully) in Ganoidei.

Relation to recapitulation. Dean, B. 1909.4. — *Morphological significance.* Cunningham, J. T. 1885.1; Reinhard, W. 1898.1,2; Sobotta, J. 1898.1.

Development in Murænoids. Boeke, J. 1902.1. — *Morphology, Trutta.* Gregory, E. H. 1899.1. — *Homologies.* Kopsch, F. 1900.1. — *Original description.* Kupffer, C. W. 1865.1.

Relation to gastrulation and concrescence. ★Sumner, F. B. 1900.1. — *Development in Teleosts.* Swaen, A. & Brachet, A. 1902.1, 1904.1.

Medullary tube

Formation and development. His, W. 1893.1; ★Locy, W. A. 1893.2, 1894.1. — *Of Teleostei.* Aichel, O. 1897.2. — *Teleostei and Petromyzon.* Calberla, E. 1877.2. — *Teleostei.* Goronowitsch, N. 1885.1; Jablonovskij, J. (*Esox*) 1899.1; Schapringer, A. 1871.1. — *Neoceratodus.* Semon, R. W. 1901.1.

For other papers dealing with this subject, see Development of central nervous system under Nervous system.

For segmental structure of the medullary tube, see under Metamerism.

Yolk-sac

Development, structure, etc. Harting, P. 1868.1; McIntosh, W. C. 1887.1 (iii); ★Virchow, H. 1892.1. — *Lepidosteus and Scyllium.* Beard, J. 1896.5. — *Caracharodon.* Sanzo, L. 1910.1.

Role of yolk-sac in larval nutrition, its absorption into the body, etc. Fabre-Domergue, P. & Biétrix, E. 1898.1. — *Absorption in Selachii.* Giacomini, E. 1894.2. — *Various Teleosts.* Ryder, J. A. 1883.1. — *Salmo.* Schumacher, S. 1900.1. — *Pelagic teleosts.* Williamson, H. C. 1897.1. — *Functions and histology, Batrachus.* Ryder, J. A. 1890.2.

For the yolk-sac functioning as a placenta in certain viviparous sharks, see Nourishment of embryo below Viviparity under Reproduction.

UMBILICAL CORD

Umbilical cord, yolk-sac cord, or "Dotterstrang," of Elasmobranchii; structure. Müller, J. 1842.3; Schenk, S. L. 1874.1. — *Sphyrna.* Gudger, E. W. 1912.1; Leuckart, F. S. 1836.1.

For the umbilical cord functioning in the transmission of food stuffs in viviparous sharks, see Viviparity in various species, in section on Reproduction.

EMBRYOLOGY AND DEVELOPMENT OF VARIOUS FISHES

This section consists of papers of a general nature dealing for the most part with the whole developmental history of the following fishes. For particular stages or specific structures, see above.

CEPHALOCHORDATA

Embryology and development of Amphioxus. Abendroth, E. R. 1870.1; ★Cerfontaine, P. 1905.1,2; ★Hatschek, B. 1881.1, Add. 1884.1, 1888.1, 1893.1; ★Kovalevskii, A. O. 1866.1, 1867.1, 1877.1; Legros, R. 1910.1; Marchand, W. 1909.1; Packard, A. S. 1875.1; Rice, H. J. 1880.1; Schultze, M. J. 1851.1; Willey, A. 1891.1; Eismond, J. Add. 1894.1. — *Multiple and partial development.* Wilson, E. B. Add. 1892.1, 1893.1.

CYCLOSTOMATA

Embryology of Myxine. Dean, B. 1899.3; Home, E. 1815.2; Retzius, M. G. 1889.1. — *Bdellostoma.* ★Dean, B. 1897.4, 1898.2, 1899.6; Doflein, F. J. 1899.4; Price, G. C. 1896.1,2.

Petromyzon — Larger researches. Balfour, F. M. 1885.1; Calberla, E. 1877.3; ★Goette, A. 1888.1, 1890.1; ★Kupffer, C. 1888.1; Müller, A. 1856.1,2; Nestler, K. 1890.1; ★Nuel, J. P. 1881.1; ★Ovsyannikov, F. V. 1870.1,2, 1889.1, 1891.2; Schultze, M. J. 1855.1, Add. 1856.1; ★Scott, W. B. 1880.1–1882.1, 1887.1.

Petromyzon. — Shorter articles, notes, etc. Agassiz, J. L. 1850.5; Home, E.

Embryology — Cont'd.

1815.2; Jammes, L. 1899.1; Kupffer, C. W. 1888.1; Schneider, A. F. 1873.1; Yarrell, W. 1831.3.

For *Ammocoetes*, the larval stage of *Petromyzon*, see under section on Anatomy.

DIPNOI

Embryology, including descriptions of larval forms. — *Ceratodus*. Caldwell, W. H. 1885.1; ★Semon, R. W. 1893.1; Severtzov, A. N. 1902.1. — *Lepidosiren*. ★Kerr, J. G. 1900.1, 1909.1. — *Protopterus*. Budgett, J. S. 1900.5, 1907.1; ★Kerr, J. G. 1900.1, 1909.1.

ELASMOBRANCHII

General papers on embryology, including descriptions of embryos. Baird, S. F. 1874.16; ★Balfour, F. M. 1874.1, 1876.1, 1878.1; Sedgwick, A. 1893.1.

Plagiostomi

Sharks and rays. Agassiz, A. 1872.1; ★Leydig, F. 1852.1; ★Müller, J. 1842.3; Rathke, M. H. 1827.1 (ii).

Selachii

General embryological papers. Bugnion, E. 1894.1; Dean, B. 1901.1; His, W. 1894.1; ★Hoffmann, C. K. 1896.1; Kast-schenko, N. 1888.1; ★Mitrofanov, P. I. 1893.1; Schultz, A. 1877.1.

Embryology of various sharks, including descriptions of embryos. — *Acanthias*. Agassiz, J. L. 1856.8; ★Kovalevskii, A. O. 1870.1; Perugia, A. 1880.1. — *Scyllium*. Bolau, C. C. 1879.1; Marqua, F. 1880.1.

Of various other sharks. — *Cestracion*. Haswell, W. A. 1897.1. — *Mustelus*. Kovalevskii, A. O. 1870.1. — *Pristiurus*. Ungaro, V. 1910.1. — *Scymnus*. Parker, T. J. 1882.1.

Batoidei

Development of Raja. Batarra, G. 1771.2; Boldo, B. M. 1797.1; Malm, A. W. 1877.1; Putnam, F. W. 1870.8; Wyman, J. 1864.1, 2, 1865.1; Beard, J. Add. 1892.1.

Embryology of Torpedo. Emmert, J. 1900.1; Fritsch, G. T. 1883.1; Leuckart, C. G. 1850.1; Perenyi, J. 1886.1; ★Ziegler, H. E. & F. 1892.1.

Holocephali

In addition to splendid plates, the entire literature of the reproduction of chimæroid fishes will be found in ★Dean, B. 1899.5, 1903.5, 1904.10, 1906.1.

For descriptions of various other fœtal Elasmobranchs, see under Oviparity and Viviparity of Elasmobranchii, under Reproduction.

GANOIDEI

Embryology and development, including descriptions of larval and post-larval stages. — *General researches.* ★Balfour, F. M. & Parker, W. K. 1882.1; Brandt, J. F. 1865.2, 1866.1; Ziegler, H. E. 1900.1.

Acipenser. Grimm, O. 1910.1; Kovalevskii, A. O., Ovsyannikov, P. & Wagner, R. 1870.1; Ovsyannikov, F. V. 1870.2, 1872.1; Ryder, J. A. 1888.2; ★Zalenskii, V. V. 1876.1–1881.1.

Amia. ★Dean, B. 1896.5; Forbes, S. A. 1878.6; Fülleborn, F. 1894.1; Anon. 410.

Lepidosteus. Agassiz, J. L. 1856.4, 1879.1, 2; Fülleborn, F. 1894.1; Wilder, B. G. 1877.1; Wright, E. P. 1878.1, 1879.2.

Polyodon. Barbour, T. 1911.1; Danforth, C. H. 1911.1.

Polypterus. Boulenger, G. A. 1898.5, 1899.8, 1900.9; Budgett, J. S. 1900.5, 1902.1, 2, 1907.1; ★Kerr, J. G. 1904.1, 1907.1, 1907.2; Guitel, F. Add. 1914.1.

TELEOSTEI

Embryology and development of Teleostei. — *General treatises and larger researches.* Cunningham, J. T. 1889.4; His, W. 1892.1; ★Gregory, E. H. 1903.1; Kingsley, J. S. & Conn, H. W. 1883.1; ★Kupffer, C. W. 1868.1; ★McIntosh, W. C. 1890.1, 1891.1–1892.1, 1896.3; ★McIntosh, W. C. & Prince, E. E. 1890.1; Reis, K. 1910.1; ★Ryder, J. A. 1884.3, 1887.2; Wenckebach, K. F. 1886.1.

Shorter papers. Eigenmann, C. H. & R. S. 1889.5; Holt, E. W. 1892.1; Voskoboïnikov, M. M. 1901.1; Weil, C. 1872.1; Williamson, H. C. 1898.1.

The larvæ and young of fresh-water Teleosts, and the corresponding stages of marine bony fishes which do not have a pelagic larval life, are found below under the various genera.

For larval and post-larval stages of the embryos of marine Teleosts, see under Planktonic Fauna.

For the embryology and development of Anguilla, Pleuronectidæ, and Salmonidæ, see under these headings in the Systematic part.

Sub-order Acanthopterygii

Division Gobiiformes. — *Gobius*. Filippi, F. 1841.2, 1846.2; Grisellini, F. 1768.1; Riedel, K. 1913.1, 1914.1.

Division Jugulares. — *Trachinus*. Brook, G. 1885.5. — *Batrachus*. Clapp, C. M. 1891.1; ★Gudger, E. W. 1910.1; Ryder, J. A. 1886.3. — *Pholis*. Ehrenbaum, E. 1897.1 (iii). — *Chirolophis*. Ehrenbaum, E. 1897.1 (iii). — *Lepadogaster*. Guitel, F. 1887.3; McIntosh, W. C. 1885.2. — *Blennius*. Steenstrup, J. J. Add. 1865.1.

Division Perciformes. — *Lucioperca* (young). Borodin, N. A. 1903.1. — *Macropodus*. ★Carbonnier, P. 1869.1–1870.2, 1872.1, 3; Mandée, R. 1907.1; ★Pouchet, G. 1872.5; Anon. 193. — *Micrometrus*. Eigenmann, C. H. 1890.3; Eigenmann, C. H. & R. S. 1889.5. — *Cynoscion*. Eigenmann, C. H. 1902.6. — *Hemichromis*. Konnertz, A. 1913.1. — *Perch*. Lereboullet, D. A. 1854.1, 2, 1862.2. — *Labridæ*. ★List, J. H. 1887.3. — *Heros*. Melnikov, V. S. 1902.1. — *Mullus*.

Prévost, C. 1828.1. — *Bryttus and Pomotis* (young). Putnam, F. W. 1861.4. — *Stizostedion*. ★Reighard, J. E. 1890.1; Ryder, J. A. 1887.2. — *Micropterus*. ★Reighard, J. F. 1906.1. — *Serranus*. Ryder, J. A. 1888.1; ★Wilson, H. V. 1891.1. — *Chaetodipterus and Roccus*. Ryder, J. A. 1887.2. — *Mesogonistius*. Schaeffer, W. 1904.1. — *Betta*. Stehr, E. 1898.1. — *Bairdiella*. Kuntz, A. Add. 1914.1.

Division *Scleroparei*. — *Comephorus* (larvæ). Dybowski, B. I. 1901.1. — *Cottus*. Ehrenbaum, E. 1897.1 (iii); Nordqvist, O. F. 1899.15, 16, 1900.8. — *Agonus and Cyclopterus*. Ehrenbaum, E. 1897.1 (iii). — *Agonus* (post-larval stages). McIntosh, W. C. 1896.4.

Division *Scombriformes*. — *Caranx*. Holt, E. W. 1893.2. — *Cybium* (*Scomberomorus*). ★Ryder, J. A. 1882.4, 1887.2. — *Elacate*. Ryder, J. A. 1887.2. — *Xiphias*. Sella, M. 1911.1.

Sub-order Anacanthini

Motella. Brook, G. 1885.3. — *Gadus*. ★Ryder, J. A. 1884.3, 1887.2; Sars, G. O. 1865.1, 1866.1, 1868.1, 1876.1.

Sub-order Catosteomi

Lophobranchii. Canestrini, G. 1871.1, 2; Jacobi, A. 1906.1. — *Syngnathus* (embryonic development). Costa, O. G. 1843.1; McMurrich, J. P. 1883.1; Quatrefages, J. L. 1842.1; Smith, W. A. 1890.1. — *Syngnathidæ*. Rathke, M. H. 1837.3. — *Hippocampus*. Ryder, J. A. 1882.2. — *Siphostoma*. Ryder, J. A. 1887.2. — *Gasterosteus*. Ehrenbaum, E. 1897.1 (iii); Horsfall, J. H. 1864.1; Prince, E. E. 1885.2; Coste, — Add. 1859.1. — *Apeltes*. Ryder, J. A. 1882.6, 1887.2. — *Solenostoma*. Willey, A. 1909.2.

Sub-order Haplomi

Pæcilia. Duvernoy, G. L. 1844.1. — *Esox*. ★Lereboullet, D. A. 1854.1, 2, 1861.2, 1862.1, 2; Ryder, J. A. 1887.2; Truman, E. B. 1869.1; Wright, E. P. 1878.1. — *Gambusia*. Ryder, J. A. 1886.7, Add. 1884.1; ★Kuntz, A. Add. 1914.2. — *Umbra*. Ryder, J. A. 1886.2. — *Fundulus*. Ryder, J. A. 1886.1; Träber-Klotsche, G. 1910.3. — *Anlopus*, *Chlorophthalmus*, and *Saurus*. Sanzo, L. 1915.1.

Sub-order Malacopterygii

Gymnarchus. ★Assheton, R. 1907.2; Budgett, J. S. (larvæ) 1900.5, 1901.1, 1907.1. — *Hyperopisus* (larvæ). Budgett, J. S. 1910.1. — *Clupea*. ★Brook, G. 1885.4; Eigenmann, C. H. & R. S. 1889.5; ★Kupffer, C. W. 1876.2, 1878.1, 2; Nishikawa, T. 1904.1; Schneider, G. 1901.5; Wilson, S. 1861.1. — *Sardine or Pilchard* (*Clupea pilchardus*). Bounhiol, J. P. 1913.1, 2; Cunningham, J. T. 1891.11; Marion, A. F. 1891.2; Roché, G. 1894.2. — *Thymallus*. Fritsch, A. J. 1879.2; Köttl, J. 1878.2. — *Coregonus* (larvæ). Nüsslin, O. 1908.1, 1910.1. — *Alosa*. Rice, H. J. 1878.2; Ryder, J. A. 1882.8. — *Osmerus*. Rice, H. J. 1878.3.

— *Mallotus*. Schmidt, E. J. 1906.2. — *Engraulis*. Wenckebach, K. F. 1887.1; Nishikawa, T. Add. 1901.1. — *Anchovia*. Kuntz, A. Add. 1914.1.

Sub-order Ostariophysii

Cyprinus. Bloch, M. E. 1782.1; Carbonnier, P. 1872.2, 1873.3; Peters, W. C. (young forms) 1871.2; Rusconi, M. 1854.1. — *Gobio*. Knauthe, K. 1891.5; Künstler, J. 1908.3. — *Cobitis*. Nehrkorn, A. 1876.1. — *Cyprinidæ*. Reinhard, W. 1888.2; Camerarius, J. R. Pre-Linn. 1683.1. — *Amiurus*. Ryder, J. A. 1883.3. — *Ictalurus*. ★Ryder, J. A. 1887.2. — *Barbus*. Stansch, K. 1904.1. — *Abramis*. Trybom, F. 1898.1. — *Misgurnus* (young stages). Werner, Franz. 1908.2. — *Plotosus* (young). Willey, A. 1908.2. — *Danio*. Zimmermann, —. 1904.1. — *Carassius*. ★Brigidi, V. & Trafani, A. Add. 1881.1.

Sub-order Pediculati

Lophius. Collins, J. W. 1880.3; Derjugin, K. M. 1901.3, 1902.1; Prince, E. E. 1891.1.

Sub-order Percosoces

Atherinopsis. Eigenmann, C. H. & R. S. 1889.5. — *Ammodytes*. Ehrenbaum, E. 1897.1 (iii). — *Belone*. Ehrenbaum, E. 1897.1 (iii); Ryder, J. A. 1882.3; Sobotta, J. 1896.2. — *Anabas*. Lönnberg, A. J. 1911.2. — *Atherina*. Marion, A. F. 1894.12. — *Ophiocephalus* (young). Willey, A. 1909.1.

Sub-order Symbranchii

Symbranchus. ★Taylor, M. 1913.1. — *Chilobanchus*. Haswell, W. A. Add. 1890.1.

EVOLUTION (IN FISHES)

The view of evolution having long been fundamental in morphological research, numerous additional related references will be found under the various organs and systems, such as Skull, Visceral skeleton, etc.

For the genetical relations between the air bladder and lung, see Homologies with lungs, under Air bladder.

For a readable popular summary of the evolution of fishes, see ★Jordan, D. S. 1902.2. With additions, this is reprinted as chapter 24 in his 1905.1.

For a somewhat more technical summary, see ★Traquair, R. H. 1900.2.

Various minor topics, recording instances of, or relating to evolution, mutation, recapitulation, selection, etc. Cope, E. D. 1868.2, 1872.2, 4, 16, 1885.2; Dean, B. 1908.2; Dollo, L. 1893.1; Eigenmann, C. H. 1905.1; Eigenmann, C. H. & Cox, U. O. 1900.1; Hussakof, L. 1910.6; Jäger, Gustav 1908.1; Kerr, J. G. 1910.5; Parker, W. K. 1879.1; Peter, K. 1910.1; Popoff, M. 1906.1; Ryder, J. A. 1885.8. Tadpole considered a stage in the transformation of fishes into frogs. Merian, M. S. Pre-Linn. 1719.1; Seba, A. Pre-Linn. 1734.1.

Fresh-water considered the habitat of the earliest vertebrates. Chamberlin, T. C. 1900.1; Pompeckj, J. F. 1914.1.

Evolution — Cont'd.

The origin of fresh-water faunas. Gill, T. N. 1905.12; Palacky, J. 1891.1; Sollas, W. J. 1884.1.

Quadrates and squamosals as progenitors of mammalian temporal. Albrecht, P. 1883.1.

Homologies of the opercular elements of fishes with the auditory ossicles of mammals. Baraldi, G. 1877.1.

Evolution as illustrated by egg-cases of Chimæridæ. Dean, B. 1904.1,2, 1912.6.

Polymorphism and evidence of mutation in Malthopsis. Lloyd, R. E. 1909.1, 1912.1.

General treatises on Evolution

In the following works, references to the evolution of fishes are usually incidental.

Text in English. ★Darwin, C. R. 1871.1, 1883.1; Lloyd, R. E. 1912.1; ★Morgan, T. H. 1916.1; ★Osborn, H. F. 1894.1, 1916.1; Phillips, J. 1860.1; Cunningham, J. T. Add. 1898.1.

Text in French. Perrier, J. O. 1884.1; Vialleton, L. 1908.1.

Text in German. ★Abel, O. 1912.1; Haacke, J. W. 1893.2; ★Haeckel, E. H. 1895.1; Keibel, F. 1898.1; Rosa, D. 1903.1; Simroth, H. R. 1891.1, 1902.1; Wagner, M. F. 1889.1.

Evolution and Palæontology

The geological succession of life in time being the history of fishes as traced on the older rocks, especially in America. Agassiz, J. L. 1835.3, 1843.2,4, 1846.4; Case, E. C. 1898.1; Cope, E. D. 1874.7; Marsh, O. C. 1877.1; Meek, S. E. 1900.2; Newberry, J. S. 1873.3; Phillips, J. 1860.1; Pohlig, H. 1909.1, 1914.1.

Palæohistological data on the origin of teleosts. Reis, O. M. 1895.3.

Palæontological evidence for the evolution of fishes. ★Traquair, R. H. 1898.1, 1900.1,2.

The imperfection of the geological record. Woodward, A. S. 1898.2.

Evolution of vertebrate animals in time, an address. Woodward, H. 1904.1.

Palæontology and the biogenetic law. Zittel, K. A. 1895.2.

The probable derivation of the Amphibia from the Crossopterygian ganoids. Gregory, W. K. 1913.2, 1915.1; Jaekel, O. 1911.1; Moodie, R. L. 1915.1,3; Pollard, H. B. 1891.1.

Dipnoi considered related to Amphibia but excluded from the direct ancestry because of specializations in skull and dentition. Semon, R. W. 1901.4.

Hypotheses of the ancestry of the vertebrates

Practically all hypotheses on the origin of vertebrates are reviewed in Delage, M. Y. & Hérouard, E. 1898.1, pp. 345-355.

In addition to the following chief hypotheses, a number additional are mentioned by Perrier, J. O. 1898.1.

Annelidan view of the derivation of vertebrates from worm-like ancestors. Various

papers discussing suggested annelidan affinities, especially in the nervous system. Beard, J. 1889.4; Bernard, H. M. 1898.1; Dohrn, A. 1876.2; Kovalevskii, A. O. 1877.1; Ryder, J. A. 1885.1; Delsman, H. C. Add. 1913.1; Semper, C. Add. 1875.1.

Arachnid hypothesis of vertebrate ancestry, based on supposed resemblances, especially in appendages of the horseshoe crab Limulus and the Ostracoderms. ★Patten, W. 1890.1, 1902.1, 1906.1, 1912.1. — *Remarks on these views.* Eastmann, C. R. 1902.5, 1903.2, 1904.4.

Arthropod hypothesis, or Gaskell's view of crustacea as ancestors of the vertebrates. ★Gaskell, W. H. 1889.1-1908.1. — *Remarks on these views.* Bordage, E. 1892.1; Dean, B. 1909.3; Jaekel, O. 1909.2; Kerr, J. G. 1910.2; Patten, W. 1899.1.

Concerning Gaskell's hypothesis, the arthropod resemblances are ascribed to parallelisms in Dollo, L. 1909.4.

Cephalic homologies, in relation to the determination of the ancestry of vertebrates. Minot, C. S. 1897.1.

Ostracoderms as forerunners of vertebrates. Woodward, A. S. 1892.5.

Protochordate origin of the vertebrates. "Amphioxus and the ancestry of the vertebrates." Willey, A. 1894.1.

Of morphologists of the highest order, few have been more productive of speculations on the origin of the vertebrates than Anton Dohrn. For these views published in German, see ★Dohrn, A. 1882.2. *For critical remarks on these views, see* Cunningham, J. T. 1884.1, 1887.1. *For summaries in English of Dohrn's theories, see* ★Scharff, R. F. 1888.2.

Unclassified papers. Goette, A. 1895.1; Jenkins, S. 1897.1; Lillie, R. S. 1896.1.

Origin of species

Origin of species through isolation. Jordan, D. S. 1905.5,6.

Coregonus fera sancti-benedicti arising from C. fera of Bodensee, after 40 years isolation in Laachersee, Prussia. Thiennemann, A. 1911.2, 1912.5, 1914.1.

PHYLOGENESIS OF LIMBS

Hypotheses of the origin of the paired limbs of gnathostomes based primarily on the study of the structure of the fins of fishes.

The paired fins of fishes (Ichthyopterygia) are universally accepted as the progenitors of the limbs (Chiropterygia) of the other classes of vertebrates or tetrapods.

For an excellent, popular résumé of the three prevalent views listed below, see ★Jordan, D. S. 1902.9. *This is reprinted as chapter v in his* 1905.1.

A shorter résumé largely quoted by Jordan is that of ★Kerr, J. G. 1900.2. *Another (in German) is that of* Jaekel, O. 1909.2.

For a learned summary of the gill-arch and the lateral fold hypotheses with a bibliography, see ★Goodrich, E. S. 1906.1.

For a scholarly presentation of the phylogenesis of limbs throughout the vertebrates, from the data of comparative anatomy and palaeontology, see ★Gregory, W. K. 1915.1.

EARLIER VIEWS

These are largely summarized in Mivart, St. G. 1879.1 and are repeated in Cope, E. D. 1890.1.

Limbs considered as diverging appendages attached to ribs, with a shoulder-girdle of axial origin. Owen, R. 1848.1.

Limbs considered homologous with epipleural spines, and external to visceral wall of body. Goodsir, J. 1857.1.

Vertical fins considered of bifold origin; paired fins considered portions of lower azygos fins prevented from uniting by interposed body-cavity. Humphry, G. M. 1870.1, 1871.1.

Vertebrate limbs considered as modified ribs by MacIise in Todd, R. B. "Encyclopædia," 1832, vol. 4, p. 70, and by Oken, 1843, "Lehrbuch der Natur-Philosophie," p. 330.

View that preaxial (upper) border of pectoral limb is homologous with the same border of the pelvic limb. Wilder, B. G. 1872.1; Wyman, J. 1868.1.

Opposite view of reversed homologies, i.e., that preaxial border of pectoral is serially homologous with ventral border of pelvis. Braus, H. 1900.1 (p. 165).

Miscellaneous or unclassified papers relating to the origin of limbs. Eisler, P. 1895.1; Gill, T. N. 1898.2; Macdonald, W. 1840.1, 1872.1; Mehnert, E. H. 1897.1; Dollo, L. Add. 1896.1.

Branchial or gill arch hypothesis

This hypothesis of Gegenbaur holds that the paired fins have been derived from gill structures, the gill-arch having been modified into the limb-girdle, and the fin itself having been derived from the gill-septum. The position of the pelvic fins is attributed to their backward migration.

It considers a biserial appendage like that of *Ceratodus* (the *Archipterygium*) as the type from which all other fins and legs have been derived by a shortening of the axis and a loss of the pre-axial radials.

The principal papers in support of this hypothesis are ★Braus, H. 1899.2, 1900.1, 1906.1; Davidoff, M. 1879.1; Fürbringer, M. 1902.1, 1903.1; ★Gegenbaur, C. 1864.2, 1870.2, 4, 1873.1, 1876.1, 1879.2, 1895.2; ★Klaatsch, H. 1896.1.

Other papers of lesser importance are Bunge, A. 1874.1; Drüner, L. 1906.1; Emery, C. 1887.2, 1897.3; Jaekel, O. 1899.3, 4; Zolenski, V. V. 1898.1, 2.

The chief points made against this hypothesis by its opponents are summarized in Goodrich, E. S. 1906.1, and in Osburn, R. C. 1907.2.

Cell-accumulation hypothesis

This view of Geddes, the most recent of all, "does not in reality oppose the lateral fin hypothesis. Rather it expands it in one direction and refines it in another. It

appears, too, to link together it and the modified gill-arch hypothesis."

Briefly, it holds that in every developing vertebrate there are five cell regions which are lines of potential cell-accumulation. At points where three regions meet, the tendency to cell-accumulation is especially marked. There are four such points and the cell-accumulations formed around them provided, far back in phylogeny, material capable of being selected to form the bases of new organs. At their commencement the limbs were, and still are, altogether independent of the cephalised axial part of the embryo, but later passed under its dominance.

For the full statement of this hypothesis, see ★Geddes, A. C. Add. 1912.1.

External-gill hypothesis

This hypothesis of Kerr considers that the external gills were potentially motor and supporting structures and have given rise to limbs. The Gegenbaur view of the backward migration of the limbs is accepted together with his derivation of the limb girdle. The necessity of a skeletal axis in the external gill is provided for by Budgett's description of a rod of cartilage projecting into the external gill of the larval *Polypterus*.

For the original presentation of this view, see Kerr, J. G. 1900.2, 1901.2.

It has been further elaborated in ★Prof. Kerr's "Text-book of Embryology," 1919, vol. 2, pp. 449-453.

Lateral fin-fold hypothesis

This hypothesis was developed simultaneously by Balfour, Thacher, and Mivart. It is now the most generally accepted.

It holds that the paired fins are the persisting remains of a once continuous longitudinal fin-fold (essentially like that of the unpaired median fins) which stretched along each side of the body. In this, supporting radials or somactidia became developed as in the median fins and subsequently gave rise to the limb-girdles.

Original formulation of this hypothesis. Balfour, F. M. 1876.1, 1878.1, 1881.1; Mivart, St. G. J. 1878.1, 1879.1; Thacher, J. K. 1876.1.

The principal support for this hypothesis, from the evidence of comparative anatomy and embryology, is to be found in the papers of Dohrn, A. 1882.2 (vi), (ix); Harrison, R. G. 1895.2; Haswell, W. A. 1883.2; Mayer, P. 1886.1; ★Mollier, S. 1893.1, 1895.1; ★Rabl, C. 1901.1, 1913.1; Wiedersheim, R. E. 1886.2, 1892.1.

Lesser papers supporting this hypothesis. ★Baur, G. H. 1885.1, 2, 1887.1, 2, 1888.1; Broom, R. 1913.3; Cope, E. D. 1890.1, 1892.6; Cunningham, J. T. 1884.1; Gregory, W. K. 1911.1, 2; Gregory, W. K. & Adams, L. A. 1914.1; ★Müller, E. 1909.1; Ryder, J. A. 1885.14, 1887.3; Thompson, D. W. 1886.1; Sauvage, H. E. Add. 1903.1.

*Embryological evidence: the embryo of an ancient type of shark, *Heterodontus* (Ces-*

Evolution — Cont'd.

tracion) japonicus "yields no evidence that there has ever been a migration of the fins in the Gegenbaurian sense." Dean, B. 1902.1. — Further emphasis of these views. ★Osburn, R. C. 1906.2–1907.2.

Palæontological evidence for the origin of the paired fins. For a summary, see ★Woodward, A. S. 1892.3.

The most primitive type of pectoral fin (in accordance with the fin-fold theory) is met with in the Devonian shark, *Cladoselache*. This type of fins was termed *Ptychopterygium* by Cope. For details see ★Dean, B. 1892.1, 1894.1, 1896.1, 1902.2. — Pectoral of *Cladoselache* considered to show no "ground for deriving the paired limbs from lateral folds." Jaekel, O. 1892.3.

EYE

Comprising the structure of the organ of sight.

For the functions of the eye, see under Vision.

For the rotation or migration of the eye in flatfishes, see under *Pleuronectidæ*.

For Diseases of the eye, see under Pathology.

For all abnormalities affecting the eye including cyclopia, see under Teratology.

For accessory eyes or "augenähnliche Organe" of Leydig, Usov, et al, see Phosphorescent organs under Luminosity, etc.

Ophthalmoscopy and dioptrics of the fish eye. Beauregard, H. 1875.1; Hirschberg, J. 1882.1.

Observations on eyes of living Selachii. ★Franz, V. 1906.1.

Size, relative to brain-weight (Sparidæ). Lapique, L. 1908.1; Lapique, L. & Laugier, H. 1908.1.

Anatomy and morphology. General treatises. Berger, E. 1882.1, 1883.1; Carrière, J. 1885.1; Friis, G. M. 1879.1; Virchow, H. 1882.1.

Miscellaneous and general. Am., Sc. 1879.1; Drummond, J. L. 1814.1; Fripp, H. E. 1866.1; Haller, A. 1762.1; Klingelhöffer, W. 1911.1; Leuckart, R. 1875.1; Rosenthal, F. 1811.2; Schiefferdecker, P. 1887.1; Ziegenhagen, P. 1895.1; Bates, W. H. Add. 1914.1; Fischer, von Waldheim, G. Add. 1830.1; Virchow, H. Add. 1881.1. — *Pre-Linn. refs.* Casserius, J. 1601.1; Derham, W. 1713.1; Dupetit, F. 1728.1.

Anatomy of eye of various fishes. *Amphioxus.* Nüsslin, O. 1877.1.

Cyclostomata, Bdellostoma, Myxine, and Petromyzon. Allen, B. M. 1902.1, 1905.1; Kohl, C. 1892.1; Langerhans, P. 1873.1; Možeyko, B. 1912.1; Retzius, M. G. 1893.1; Studnička, F. K. 1912.2.

Elasmobranchii. ★Franz, V. 1905.1; Tiesing, B. 1895.1.

Ganoidei and Dipnoi (Protopterus). Denissenko, G. 1889.1; Grynfeldt, E. 1911.1; Hosch, — 1904.1.

Teleostei. Deichsel, G. 1908.1. — *Coryphæna.* Albers, J. A. Add. 1808.1. — *Boleophthalmus* and *Periophthalmus.*

Baumeister, L. 1911.1, 1913.1; Klingelhöffer, W. 1912.1; Volz, W. 1905.2,3. — *Gadus.* Deslongchamps, J. A. 1853.2; Albers, J. A. Add. 1806.1, 1808.1. — *Scomber.* Dyce, R. 1866.1; Massalien, F. C. 1815.1. — *Thynnus.* Faravelli, E. 1890.1; Jurine, L. 1821.1; Massalien, F. C. 1815.1; Moreau, E. 1872.1. — *Xiphias.* Grant, R. E. 1826.1; Lauber, — 1904.1; Ciaccio, G. V. Add. 1883.1. — *Carassius.* Hirsch, J. 1912.1. — *Silurus.* Matthiessen, H. F. 1886.1. — *Orthogoriscus.* Meek, A. 1904.4. — *Cyprinidæ.* Thilenius, G. 1892.1. — *Perca.* Wallace, W. C. 1835.1, *Pleuronectes.* 1834.2; — *Lurarus.* Berger, E. Add. 1881.1.

For the structure, etc., of the degenerate eyes of the blind fishes, chiefly *Amblyopsidæ*, see under Blind fishes of the caves. See especially Eigenmann, C. H. 1909.2.

For the highly modified eyes of abyssal fishes, see under Deep sea fishes. For papers going into the subject most fully, see Brauer, A. 1902.2,3.

Anableps, the "four-eyed fish," a South American *Poeciliid*, has the eye divided by a horizontal constriction to permit vision both in the air and in the water. References are: M. C. Marsh in Evermann, B. W. & Goldsborough, E. L. 1902.3, p. 150; Klinckowström, A. 1893.1; Lacépède, B. G. 1799.2, Add. 1797.1; Schneider, J. G. 1803.1; Schneider von Orelli, M. 1908.1; Meckel, J. F. Add. 1818.1.

Development and embryology. General accounts. Desmoulins, L. A. 1823.1; ★Froriep, A. 1906.1; Rathke, M. H. 1833.1; Schenk, S. L. 1867.1; Stockard, C. R. 1910.1; Waele, H. 1900.1. — *Dev. of telescopic eye, Goldfish.* Camuset, G. 1874.1.

Invagination of optic vesicle. Froriep, A. 1905.4; Locy, W. A. 1894.2,3; Studnička, F. K. Add. 1913.1. — *Coloboma, persistence of the choroid fissure.* Bergmeister, O. 1875.1; Virchow, H. Add. 1900.1.

Development of circulatory system. Beauregard, H. 1876.1; Kittlitz, A. F. 1906.1; Virchow, H. 1890.1, Add. 1900.1.

Evolution, origin, and phylogeny. Dohrn, F. A. 1882.2(x); Froriep, A. 1906.2; Gaskell, W. H. 1898.1 (ix); Jellgersma, G. 1906.1; Müller, W. 1875.2; Parker, G. H. 1908.1; Metcalf, M. M. Add. 1906.1. — *Primitive organs of sight.* Beer, T. 1901.1. — *Origin in skin.* Bernard, H. M. 1897.1; Parker, G. H. 1908.1. — *Phylogenetic significance of eye of Amphioxus.* Boveri, T. 1904.2. — *Significance of integumentary nerves for origin of eyes.* Parker, G. H. 1909.1,2.

Histology, in certain fishes. — *Myctophum* and *Sternoptyx.* Brauer, A. 1904.3. — *Morrhua.* Cobbold, T. S. 1862.1, 1862.2. — *Selachii.* ★Franz, V. 1905.1. — *Cephalopterus.* Mazza, F. 1889.1.

ACCESSORY PARTS OF EYE**Parts external to bulbus oculi**

Ligamentum annulare, a structure lying in anterior chamber between cornea and iris. Ballowitz, E. 1913.5; Kolmer, W. 1913.1.

Relation of orbital wall to bulb. Harman, N. B. 1899.1.

Recessus orbitalis, an apparatus causing protrusion of the eye in *Pleuronectidae*. Brown-Sequard, C. E. 1870.1; Holt, E. W. 1893.2; 1894.1.

Choroid gland. *Extra-retinal capillary blood-vessels surrounding optic nerve. Structure.* Brass, A. 1881.1; Cobbold, T. S. 1862.1,2; Erdl, M. P. 1839.1; Müller, J. 1840.3,4, Add. 1912.1.

Oculo-motor apparatus, or muscles of the eye. *Anatomy and morphology.* ★Allis, E. P. (*Mustelus*) 1901.1; Couch, R. Q. 1851.2; Harman, N. B. 1899.1; Tiesing, B. 1895.1; ★Corning, H. K. Add. 1900.1.

Development. Dohrn, F. A. 1882.2 (xvi); Nussbaum, M. 1901.1; Lamb, A. B. (*Acanthias*) 1902.1.

Palpebral apparatus. *Morphology and development.* — *Nictitating membrane and muscles, Selachii.* ★Harman, N. B. 1899.1; ★Ridewood, W. G. 1898.1; Rynberk, G. A. 1906.3. — *Eye-lids and fornix conjunctivæ, teleosts.* Hein, S. A. 1913.2.

Nictitating membrane of eyes of Selachii figured. Garman, S. 1913.1.

BULBUS OCULI**The eyeball and its parts**

Choroid coat, or vascular membrane of the eye. — *Histology.* Grynfeldt, E. & Euzière, J. 1913.1. — *Tapetum lucidum, structure.* Blainville, H. M. 1822.1; Brücke, E. Add. 1845.1. — *Effect of light on tapetum.* Exner, S. & Januschke, H. 1905.1,2; Januschke & Exner 1905.1.

Iris, the colored visible part of the choroid coat surrounding the pupil. Contraction and expansion through influence of light, temperature, etc. Bateson, W. 1890.1,2; Brown-Séquard, C. E. 1859.1; Couch, J. 1866.5; Lieto-Vollaro, — 1908.1; Magnus, R. 1899.1; Müller, H. 1860.1, 1861.1; Reinhardt, J. C. 1837.1; Steinach, E. 1890.1; Guth, E. Add. 1901.1. — *Influence of colored lights.* Gysi, E. & Luchsinger, B. 1879.1.

Pupil, shapes of. Buchanan, H. 1822.1; Franz, V. 1906.1. — *Pupillary operculum (a projecting part of iris on dorsal edge of pupil helping to determine its shape).* Grynfeldt, E. & Demelle, A. 1908.1.

For the role of the falciform process of the choroid in vision, see Accommodation under Vision.

Crystalline lens. *Anatomical structure.* Brewster, D. 1816.1, 1831.1, 1833.1, 1836.1; Pflugk, A. 1909.1. — *Selachii.* Froriep, A. 1905.2. — *Petromyzon.* Gulliver, G. 1869.2. — *Anguilla.* Virchow, H. 1882.2. — *Aplanatism and periscopism.* Matthiessen, H. F. 1880.1, 1881.1.

— *Early ref.* Leeuwenhoek, A. Pre-Linn. 1684.2, 1706.1.

Chemical composition. Payen, A. 1857.1; Valenciennes, A. & Fremy, E. 1854.3.

Histogenesis and development. Addario, C. 1902.3; Koranyi, A. 1886.1; Stockard, C. R. 1907.2, 1910.2,3. — *Regeneration in teleosts.* Grochmalicki, J. 1908.1, 2,3. — *Morphogenetic constitution, a thigmomorphic organ.* Mencl, E. 1903.1, 2,4, 1908.1.

Retina. *Anatomical structure in various fishes.* Denissenko, G. 1882.1; Dogiel, A. S. 1883.1,2; Gottsche, C. M. 1834.2; Heinemann, C. 1878.1; Hyrtl, C. J. 1861.1; Leydig, F. 1894.1; Retzius, M. G. 1896.1, Add. 1905.1; Schultze, M. J. 1871.1, 1872.1.

Development. ★Fürst, C. M. 1904.1; Gunn, R. M. 1888.1; Kupffer, C. W. 1868.2.

Histological structure. Aichel, O. 1896.1; Fritsch, G. T. 1904.1; Krause, W. 1885.1, 1892.1; Kolmer, W. 1909.1; Neumayer, L. 1896.1; Ramon y Cajal, S. 1892.1, 1894.1; Reich, M. 1874.1; Wetzel, G. 1908.1. — *Outer granular layer.* Denissenko, G. 1881.1. — *Retinal epithelium.* Kochetov, N. A. 1908.1. — *Inner granular layer.* Retzius, M. G. 1871.2. — *Retinal cells, arrangement, simulating compound eyes.* Ryder, J. A. 1896.1. — *Neuroglia cells in retina.* Sacchi, J. 1884.1. — *Neurofibrils in retinal ganglion cells, Selachii.* Schnaudigel, O. A. 1905.1.

Guanin in retinal epithelium. Cunningham, J. T. & MacMunn, C. 1893.1; Kühne, W. & Sewall, H. 1880.1.

Rods and cones, arrangement. Cobbold, T. S. (*Morrhua*) 1862.1,2; Eigenmann, C. H. & Hansell, G. 1899.1; Eigenmann, & Shafer, G. D. 1900.1; Ritter, C. 1891.1; Schaper, A. 1899.1. — *Mosaic of single and twin cones, Micropterus.* Shafer, G. D. 1900.1.

Visual purple; pigment of the rods. Abelsdorff, G. 1895.1, 1896.1; Abelsdorff, H. 1897.1; Bigelow, H. R. 1880.1. — *Two kinds, one in mammals, birds and amphibians, other violet-red in fishes.* Köttgen, E. & Abelsdorff, G. 1895.1.

Fovea centralis, or point of acute vision. Structure, etc. Biagi, G. (*Lophobranchii*) 1899.1; ★Chievitz, J. H. 1889.1–1891.1; Gulliver, G. 1868.1; Slonaker, J. R. 1896.1.

Innervation or peripheral endings of optic nerve in retina. Barbieri, N. A. 1912.1; Krause, W. 1876.1, 1885.1, 1892.1. — *Nerve elements, Ganoidi.* Dogiel, A. S. 1888.1. — *Selachii.* Schaper, A. 1899.1.

Membrana limitans. Addario, C. 1902.1; Retzius, M. G. 1904.1.

Vascularization of retina. Denissenko, G. 1880.1. — *Conger.* Grynfeldt, E. & Euzière, J. 1908.1. — *Anguilla.* Virchow, H. 1882.2.

Physiology of retina, experimental. — *Effects of light and darkness.* Chiarini, P. 1905.1, Add. 1904.1; Ricci, O. 1901.1.

Eye — *Cont'd.*

— *Effect of light.* Exner, S. & Januschke, H. 1906.1; Heger, P. 1896.1; Garten, S. Add. 1907.1; Gundersen Stort, A. G. Add. 1886.1, 1887.1. — *Effect of darkness.* Ogneff, J. F. 1910.1, 1911.1.

Sclera, the sclerotic coat of the eye. *Structure.* Langhans, T. 1865.1; Wedl, C. 1848.2.

Cornea. — *Iridescent reflection, in living Labroids.* Emery, C. 1876.1, 1878.1. — *Membrane of Descemet.* Grynfeldt, E. 1910.1. — *Innervation of cornea.* Shearer, C. 1898.1; Zelinka, C. 1881.1, 1882.1.

Structure of the cornea in various bottom-dwelling fishes. Harms, W. Add. 1914.1.

Vitreous humor. *Histogenesis.* Ad-dario, C. 1902.2. — *Marsupium nigrum, a vascular structure in the vitreous.* Knox, R. 1824.2.

For a general treatise on the vitreous humor with a full review of the literature, see Virchow, H. Add. 1900.1.

FAUNA OF THE WORLD

Arranged by continents and thereunder chiefly under political divisions; enclosed or surrounding seas; contiguous islands, etc. If in doubt concerning the placement of a specific locality, see the index.

The status of political divisions is that existing during the period covered by this work, *i. e.* prior to the World War of 1914. Orthography, abbreviations and geographical arrangement follow the Century Atlas.

A map of the country concerned will be found convenient by the user of this section. For Deep-sea, Pelagic and Planktonic Faunas, see respectively under these items. For fossil fauna, see Palæontology. For sporting papers, see under Fisheries and Fishing methods.

ISLANDS

(Not placeable under continents)

Islands of South Atlantic Ocean

Ascension I. Günther, A. 1881.4; Nichols, J. T., & Murphy, R. C. 1917.1. — *Fernando Noronha I.* Boulenger, G. A. 1890.6. — *St. Helena I.* Clark, R. S. 1913.1; Cunningham, J. T. 1910.2; Günther, A. 1868.8, 1869.10; Martin, M. 1834.1; Melliss, J. C. 1875.1. — *South Georgia Is.* Fischer, J. G. 1885.1; Lönnberg, A. J. 1906.1. — *South Trinidad.* Nichols, J. T., & Murphy, R. C. 1914.1. — *Tristan da Cunha I.* Carmichael, D. 1817.1; Regan, C. T. 1913.8.

Islands of Indian Ocean

Mauritius, Réunion, Rodriguez, etc., see Indian Ocean Is. under Asia.

POLAR REGIONS**Antarctic Regions**

General: ★Dollo, L. 1904.1. — *Distribution of fishes.* ★Regan, C. T. 1914.1, 1916.3; Roule, L. 1911.3. — *Supposed resemblance to fauna of Arctic regions.*

Thompson, D. W. 1897.1. — *Various papers.* Boulenger, G. A. 1902.30, 1907.7; Chun, C. 1897.1 (*Plankton*); Dollo, L. 1900.1-4, 1906.2-1907.1, 1908.1-1909.1, 3; Drygalski, E. 1904.1; G., J. W. 1906.1; Jacquinet, H., & Guichenot, A. 1853.1; Lönnberg, A. J. 1905.3, 6; Pappenheim, P. 1911.2, 1912.1, 1914.1; Pfeffer, G. J. 1890.2; Roule, L. 1913.2, 3; Roule, L., & Despax, R. 1911.1; Regan, C. T. 1913.1, 1914.1, 4, 1916.3; Vaillant, L. L. 1906.1-1906.3, 1907.1; Vanhöffen, E. 1901.1; Waite, E. R. 1909.2, 1911.3, 1916.2; Lampe, M. Add. 1914.1.

Kerguelen I.: Gill, T. N. 1876.1; Günther, A. 1879.3.

Arctic Regions

See also Alaska, Canada and Greenland under America, and Iceland and Spitzbergen under Europe.

General treatises: lists, etc. Bean, T. H. 1883.4; ★Ehrenbaum, E. 1901.2 in Römer, F., & Schaudinn, F. R. 1900.1; Jensen, A. S. 1905.1; Pennant, T. 1784.1-1792.1. — *Various papers, chiefly marine fauna.* Dewhurst, H. W. 1834.1; Gray, J. E. 1850.1; Grieg, J. A. 1896.1; Günther, A. 1877.1, 3, 8, 1878.2, 1881.2; Holmquist, O. 1899.1; Jensen, A. S. 1910.2; Knipovich, N. M. 1894.1, 1902.2, 1905.1; Peters, W. C. 1874.1; Phipps, C. J. 1774.1; Richardson, J. 1823.1, 1825.1, 1855.1, Add. 1836.1; Ross, J. C. 1826.1, 1828.1; Ross, J. 1835.1; Sabine, E. 1824.1, 2; Sabine, J. 1823.1; Scoresby, W. 1820.1. — *Distribution of animals available as food.* Petermann, A. H. 1852.1. — *Barents Sea.* Atkinson, G. T. 1908.1; Breitfuss, L. L. 1908.1; Breitfuss, L. L., Soldatov, V. K., & Göbel, J. 1908.1; Linko, A. 1907.1; Pietschmann, V. 1907.1. — *Bear I.* Malmgren, A. J. 1865.1. — *Kara Sea.* Lütken, C. F. 1887.1; Kerbert, C. Add. 1887.1. — *White Sea.* Khvorostansky, C. 1892.1; Knipovich, N. M. 1897.2, 1906.2, 3, 1907.2; Kuznetsov, I. D. 1908.2; Levander, K. M. 1888.1, 2.

Jan Mayen I.: Le Danois, E. 1913.3, 1914.1; Steindachner, F. 1886.1; Vaillant, L. 1894.1.

AFRICA

Arrangement based upon Century Atlas of the World, 1913.

General treatise

Catalogue of the fresh-water fishes of Africa. ★Boulenger, G. A. Add. 1909.1; (List) 1905.6.

Distribution of fresh-water fishes

Boulenger, G. A. 1905.5; Dambeck, K. 1877.4, 1879.2; Duméril, A. 1858.4; Kemna, A. 1905.2; Pappenheim, P. 1910.1; Pellegrin, J. 1911.4, 1912.5; Poche, F. 1901.1. — *Origin of fauna.* Palacky, J. 1907.1. — *Zoogeographical relations.* Day, F. 1885.12; Gill, T. N. Add. 1900.1. — See also ★Nichols & Griscom, in Bull. Amer. Mus. Nat. Hist., 1917, vol. 37, pp. 734-752.

Works of travel

With incidental references to the African fauna. Burchell, W. J. 1822.1; Dahl, K. 1897.1; Russegger, J. 1841.1,2; Stanley, H. M. 1880.1, 1890.1.

Abyssinia: *Fresh-water fauna.* Boulenger, G. 1902.12; Pellegrin, J. 1905.8; Rüppell, W. 1835.2; Steindachner, F. 1861.3, 1906.2; Vinciguerra, D. 1883.3, 1893.1, 1897.1–1898.1. — *Work of travel.* Baker, S. W. Add. 1868.1. — *Marine fauna.* Guichenot, A. Add. 1847.1.

Algeria: *General.* Gervais, F. 1848.1, 1866.2, 1867.2, 1874.3; Guichenot, A. 1850.2; Werner, Franz. 1914.1. — *Works of travel.* Rozet, C. A. 1833.1; Scherer, J. 1905.1; Wilde, W. 1840.1. — *Fresh-water fauna.* Baird, S. F. 1871.20; Blanchard, R. 1903.1 (*Hamman-Meskoutine*); Bounhiol, J. P. 1907.1; Duméril, A. H. 1858.3, 1863.1; Gervais, F. 1853.1; Günther, A. 1859.4 (*Tuggurt.*); Hult, R. 1895.1; Letourneux, A., & Playfair, R. L. 1871.1; Pellegrin, J. 1911.8; Raveret-Wattel, C. 1904.3; Rolland, G. F. 1881.1, 1895.1 (*Oued Rir*); Valenciennes, A. 1858.2. — *Marine fauna.* Bounhiol, J. P. 1908.1; Cépède, C. 1907.5; Pellegrin, J. 1913.3, 1914.2; Théry, A. 1909.1.

Bechuanaland: *Lake Ngami.* Boulenger, G. A. 1911.14.

Canary Islands: *Chiefly marine fauna.* Bory de Saint-Vincent, J. 1804.1; Buchet, G. 1900.1; Jordan, D. S., & Gunn, J. A. 1899.1; Ledru, A. P. 1810.1, 1811.1; Steindachner, F. 1865.3, 1882.1, 1891.1; ★Valenciennes, A. 1835.1, 1838.1. — *Catalogue.* ★Vinciguerra, D. 1883.1, 1890.1, 1893.2.

Cape Colony: *Fresh-water fauna.* Castelnau, F. 1861.1; ★Gilchrist, J., & Thompson, W. 1911.2, 1913.1 (*General treatise*); Regan, C. T. 1908.1; Smith, A. 1849.1; Trimen, R. 1893.1. — *Marine fauna.* Boulenger, G. A. 1902.19, 1903.8; Flint, W., & Gilchrist, J. 1905.1; Gilchrist, J. 1899.1–1913.3, (*Catalogue*) 1902.1; Günther, A. 1890.2; Regan, C. T. 1904.4; Thompson, W. W. 1914.1 (*Catalogue*); Gilchrist, J. Add. 1914.1–Add. 1914.5; Layard, E. L. Add. 1869.1.

Cape of Good Hope: *Chiefly marine.* Bleeker, P. 1859.7, 1860.12, 1863.29, 1865.5, 1875.1; Boulenger, G. A. 1890.3, 1899.3,5, 1900.5,13, 1902.6,9,11,26; Castelnau, F. 1860.1, 1861.1; Forster, J. H. 1844.1; Gray, J. E. 1838.1; Pappe, C. W. 1854.1 (*Synopsis, edible fishes*); Sparrmann, A. 1772.1, 1785.1; Trimen, R. 1891.1; Villet, — 1825.1.

Cape Verde Is.: *Chiefly marine.* Cardoso, J. 1895.1, 1900.1; Jenyns, L. 1842.1; Osorio, B. 1890.1, 1898.1, 1906.1; Trotschel, F. H. 1866.1,2.

Chad, Lake: Boulenger, G. A. 1905.13; Lönnberg, A. 1906.3. — *Lake Chad, Shari, and Komadugu rivers.* Pellegrin, J. 1904.5, .9, 1908.8, 1909.10,13, 1914.3.

East Africa, British: Alluaud, C.

1904.1 (*Athi R.*); Boulenger, G. A. 1912.4, .7, *Gondokoro*. 1902.24, *Kenya*. 1902.28, 1905.9, *Kilimanjaro*. 1903.5, *Gallaland*, 1903.15, 1906.8; Günther, A. 1894.3 (*Mt. Kenia*); Hilgendorf, F. M. 1905.1; Lönnberg, A. 1911.1,3; Pellegrin, J. 1909.5, 1910.1; Peters, W. C. 1882.1 (*Athi R.*); Roosevelt, T. 1910.1 (*Narrative of travel*). — *Albert Nyanza (Lake).* Baker, S. W. 1866.1; Boulenger, G. A. 1901.9. — *Albert Edward Nyanza (Lake).* Boulenger, G. A. 1901.9. — *Lake Rudolf.* Günther, A. 1896.4; Pellegrin, J. 1905.8; Smith, A. D. 1897.1; Vinciguerra, D. 1897.2, 1898.1. — *Victoria Nyanza (Lake).* Boulenger, G. A. 1901.16, 1903.9, 1904.6, 1906.5; Hilgendorf, F. M. 1888.2; Pellegrin, J. 1904.4,13, 1909.14, 1913.14. — *Uganda.* Boulenger, G. A. 1902.21, 1906.1, .27, 1908.8, 1909.8, 1911.2,11,15, 1912.5,6; Werner, Franz. 1906.1.

East Africa, German: Alluaud, C. 1904.1; Brüning, C. 1903.5; Decken, C. 1869.1; Fischer, J. G. 1884.1 (*Masai Basin*); Hilgendorf, F. M. 1891.1, 1894.1, 1905.1 (*Kingani R.*); Jatzow, R. & Lenz, H. 1898.1; Martens, E. 1869.1; Pappenheim, P. 1906.2, 1907.2, 1914.2; Pappenheim, P., & Boulenger, G. A. 1914.1; ★Pfeffer, G. J. 1893.1,2, 1894.1, 1897.1. — *Kilimanjaro.* Günther, A. 1889.6; Lönnberg, A. J. 1907.2, 1910.2; Peters, W. C. 1868.4,6, 1869.1. — *Rukwa Lake.* Boulenger, G. A. 1911.3; Hilgendorf, F., & Pappenheim, P. 1903.1.

East Africa, Portuguese: Boulenger, G. A. 1907.1; Fermor, X. 1913.1 (*Port Beira*); Peters, W. 1878.1 (*Mombus*); Reichenow, A. 1877.1. — *Mozambique.* Bianconi, G. G. 1846.1, 1853.1, 1855.1; Capello, F. 1871.1; Fischer, J. G. 1885.1; Pellegrin, J. 1905.7; Peters, W. 1844.1, 1852.1, 1855.1, 1868.1,2. See also below under Zambesi R.

Egypt: *General.* Forskål, P. 1775.1, 1776.1; Hemprich, F. G., & Ehrenberg, C. G. 1899.1. — *Voyages and travels.* Kammerer, P. 1906.3; Olivier, G. A. 1802.1; Varthema, L. 1824.1; Wilde, W. R. 1840.1. — *Mummified fauna of ancient Egypt.* Gal, F. G. 1902.1; Lortet, L., & Gaillard, C. 1903.1–1909.1; Lortet, L., & Hugounenq, L. 1901.1; Pellegrin, J. 1900.7. — *Fresh-water fauna.* Boettger, D. 1896.1; ★Boulenger, G. A. 1907.15 (*General treatise*), 1904.8; Cunningham, W. A., & Boulenger, C. L. 1909.1 (*Birket el Qurun Lake*); Erdl, M. P. 1846.2; Fowler, H. W. 1914.2; Hilgendorf, F. M. 1903.2 (*Alexandria*); Pfeffer, G. J. 1889.1; Sauvage, H. E. 1880.4; Werner, Franz. 1909.1 (*Barca R.*). — *Marine fauna.* Bellotti, C. 1874.1; Mitchell, J. C. 1895.1 (*Lake Menzaleh*). — *Intrusion of Red Sea and Mediterranean elements into Suez Canal.* Tillier, M. 1913.1; Tillier, J. B. 1902.1; Krukenberg, C. F. Add. 1882.1. — See also below under Nile R.

Equatorial Africa, French: *Fresh-water fauna.* Boulenger, G. A. 1901.1, 1902.1; Giebel, C. G. 1878.1; Pellegrin,

Fauna — Cont'd.

J. 1899.1, 1900.4, 5, 1901.3, 1905.9; Vailant, L. 1899.3, 1908.1. — *Ogowe R.*, see under Gabun. — *Marine fauna.* Günther, A. 1867.6; Pellegrin, J. 1913.4, 1914.2; Reichenow, A. 1875.1.

Eritrea: *Marine fauna.* Borsieri, C. 1904.1; Giglioli, E. H. 1888.1. See also below under Red Sea.

Gabun or Gaboon: *Chiefly fresh-water.* Boulenger, G. A. 1890.1; Fowler, H. W. 1903.6; Gill, T. N. 1863.20; Pellegrin, J. 1913.12; Sauvage, H. E. 1884.3; Steindachner, F. 1882.2. — *Ogowe R.* Boulenger, G. A. 1911.7; Günther, A. 1896.5; Peters, W. C. 1877.4; Pellegrin, J. 1906.4, 1907.17, 1908.1, 18, 1909.3, 1909.7, 1911.2, 3, 1913.6, 1914.1, 1915.1; Sauvage, H. E. 1879.3, 1880.3.

Gambia: *Gambia R.* Assheton, R. 1907.3; Boulenger, G. A. 1900.11, 1907.8 (*Lists*); Budgett, J. S. 1907.1; Günther, A. 1865.4; Reeve, H. F. 1912.1 (*Gen. nat. hist.*); Bowdich, (Mrs.) T. E. Add. 1825.1.

Guinea: *Dahomey.* Osorio, B. 1895.2; Pellegrin, J. 1913.4, 1914.2. **French Guinea:** Klapotcz, A. 1913.1; Pellegrin, J. 1907.13, 1908.13, 15, 1911.1, 1913.4, 5, 1914.2. **Gold Coast:** Bleeker, P. 1861.7, 1862.5, 1863.11, 1865.10; Boulenger, G. A. 1903.4, 1904.4, 1911.7, 1913.6; Günther, A. 1867.6, 1899.1, 1903.1; Sauvage, H. E. 1882.5. — *Early voyages to Guinea or the Gold Coast, in Pre-Linn. section.* Bosman, W. 1704.1; Hortop, J. 1591.1; Labat, J. 1728.1; Le Maire, 1695.1; Mares, P. 1602.1; N. —, 1719.1. **Gulf of Guinea:** Brauer, A. 1902.1; Osorio, B. 1896.2. — *Annobon I.* Osorio, B. 1895.1. — *Elobey I.* Fischer, J. G. 1885.1; Osorio, B. 1896.1; Regan, C. T. 1912.8, 9. — *Fernando Po I.* Osorio, B. 1896.1, 2, 1898.1, 1906.1; Peters, W. C. 1877.4. — *St. Thomas I.* Fischer, J. G. 1885.1; Greeff, R. 1884.1, Add. 1882.1; Osorio, B. 1892.2, 1896.2, 1898.1, 1906.1, 3. **Ivory Coast:** Pellegrin, J. 1913.4, 1914.2. **Portuguese G.:** Boulenger, G. A. 1909.6, 1910.1, 1911.8, 12, 1913.4. **Spanish G.:** Boulenger, G. A. 1905.12, 1910.5; Pappenheim, P. 1911.3.

Kamerun or Cameroon: *Chiefly fresh-water fauna.* Boulenger, G. A. 1901.3, 1903.6, 13, 1904.2, 4, 1906.3, 1907.4, 5, 1908.1, 1909.5, 1911.6, 7, 10, 1913.5, Add. 1914.2; Ehrenbaum, E. 1913.1; Esch, E., Solger, F., Oppenheim, M., & Jaekel, O. 1904.1; Fischer, J. G. 1884.1, 1885.1; Keilhack, F. L. 1910.2; Lönnberg, A. J. 1895.4, 1903.9, 1904.4; Pappenheim, P. 1905.2, 1911.3; Pellegrin, J. 1907.12; Peters, W. C. 1877.4, 5 (*Victoria R.*). — *Dscha R.* Steindachner, F. 1906.2, 1912.1, 1913.2.

Kongo, Belgian: *General treatises.* ★Boulenger, G. A. 1898.8, 1901.22. — *Various localities.* Boulenger, G. A. 1900.2, 18, 1901.12, 1902.25, 1907.3, 5, 1909.1, 1911.6, 1912.8, *Mangala.* 1896.2, *Monsembé.* 1899.4, *Lake Kivu.* 1901.10, 23,

Lindi R. 1902.1, *Kasai R.* 1905.10, *San-kuru R.* 1911.13, *Katanga* 1912.1, *Lulua-bourg* 1913.1, *Kondué.* 1913.2, *Uelé R.* 1913.7; Dollo, L. 1896.1; Pellegrin, J. 1900.1, 1908.12, *Ubangi R.* 1901.1, 1903.1, 1904.3, 1906.2, *Uelé R.* 1903.3, 1908.7; Perugia, A. 1891.2; Popta, C. M. 1901.4 (*Kasai R.*); Sauvage, H. E. 1884.6; Wilverth, E. 1897.1, 1911.1.

Kongo, French; see Equatorial Africa, French.

Kongo R.: Boulenger, G. A. 1887.4; Cornet, J. 1893.1; Schilthuis, L. 1890.1; Steindachner, F. 1911.1; Tuckey, J. K. 1818.1.

Liberia: Boulenger, G. A. 1908.2, 1911.5, 7; Büttikofer, J. 1890.1; Hubrecht, A. A. 1881.2 (*St. Paul's R.*); Steindachner, F. 1867.4 (i), 1894.1.

Libya; see Tripoli.

Madagascar (I.): *Fresh-water fauna.* Bertrand, L. 1900.1; Pellegrin, J. 1914.5-9; Regan, C. T. 1903.3; Sauvage, H. E. 1891.1; Steindachner, F. 1881.1 (i); Vaillant, L. 1894.2. — *Marine fauna.* Bleeker, P. 1867.1, 1868.5, 1869.1, 1873.3, 1878.5, *Nossi Bé I.* 1869.2; Bleeker, P., & Pollen, F. 1874.1, Add. 1875.1; Guichenot, A. 1866.1, 1869.1; Jatzow, R., & Lenz, H. 1898.1; Lenz, H. 1881.1 (*Nossi Bé I.*); Pellegrin, J. 1907.4, 1908.11, 1914.7-10; Playfair, R. L. 1868.1; Connorton, J. G. Add. 1892.1. — *Catalogue.* Pollen, F. P. 1863.1, 1868.1. — *General treatise.* ★Sauvage, H. E. 1875.4. — *Narratives of residence and travel.* Sibree, J. 1915.1; Völtzkow, A. 1896.1. — *For adjacent islands, see Indian Ocean Is., under Asia.*

Madeira Is.: *Chiefly marine.* Boulenger, G. A. 1899.9; Brown, F. H. 1869.1; Capello, F. 1871.1; Cligny, A. 1912.2; Collett, R. 1886.1, 1889.1, 1890.1, 1896.2; Forster, J. R. 1844.1; Günther, A. 1864.8; Guimarães, A. R. 1884.2, 1885.2; Johnson, J. Y. 1862.1-1890.1; ★Lowe, R. T. 1843.1 (*General treatise*); *Synopsis.* 1839.1, 1841.1, *Varia.* 1833.1-1852.1, Add. 1832.1; Riddell, M. 1792.1; Taylor, E. M. 1882.1; Vinciguerra, D. 1883.1; Bowdich, T. E. Add. 1825.1.

Morocco: *Fresh-water fauna.* Baader, F. 1875.1; Boulenger, G. A. 1902.7, 1905.1; Günther, A. 1874.5, 1901.3, 1902.2; Pellegrin, J. 1912.10, 11, 1913.11, Add. 1913.1. — *Marine fauna.* Buen y del Cos, O. 1912.1; Cligny, A. 1912.8, 10, Add. 1909.1; Escribano, C. 1909.1; Fage, L. 1911.4; Pellegrin, J. 1913.3, 13, 1914.2; Pietschmann, V. 1906.1; Seabra, A. F. 1913.1.

Natal: *Fresh-water fauna.* Boulenger, G. A. 1902.2, 1904.3, 1907.12, 1908.7; Cope, E. D. 1869.2; Regan, C. T. 1908.1; Weber, M. C. 1895.1, 1897.1. — *Marine fauna.* Boulenger, G. A. 1902.5, 1903.7; Gilchrist, J. D., & Thompson, W. W. 1908.2, Add. 1914.1; Millar, A. D. 1899.1; Regan, C. T. 1906.5, 1908.1, 1916.2.

Niger River: see also Nigeria and Sudan.

Bennett, E. T. 1834.1; Boulenger, G. A. 1901.5, 18, 1902.32, 1904.5, 1908.2, 1909.4, 1911.7, 1912.2, 1913.4; Brüning, C. 1913.1; Günther, A. 1865.2, 3; Pellegrin, J. 1906.7, 1913.10.

Nigeria: Boulenger, G. A. 1901.8, 1902.3, 1903.4, 1910.1, 1911.7, 11; Popta, C. 1913.1; Regan, C. T. 1912.8, 1915.1, — *Old Calabar*. Bird, J. 1875.1; Boulenger, G. A. 1898.2, 1911.7; Cleland, J. 1859.1; Günther, A. 1896.5; Murray, A. 1854.1; Smith, John A. 1863.5, 1867.1, 2, 6, 7, 8.

Nile system; including Blue and White Nile rivers. See also Abyssinia and Egypt. Anderson, (Rev.) J. 1899.1 (*Pop. acc't*); Baker, S. W. 1866.1; Bilharz, T. 1852.1; ★Boulenger, G. A. *General treatise*, 1907.15, *Varia*, 1901.7, 11, 1903.10, 1905.3, 1906.12, 1912.6, 1913.3; Bruce, J. 1790.1; Flower, S. S. 1900.1; ★Geoffroy-St.-Hilaire, E. 1802.2, 3, 1809.2; Geoffroy-St.-Hilaire, I. 1827.2; Günther, A. 1864.1, 1869.7; Heckel, J. 1851.6, 1854.2; Hull, E. 1895.1; Joannis, L. 1835.1; Klunzinger, C. 1877.1–1878.1; Kner, R. 1865.2; Pellegrin, J. 1906.10; Pococke, R. 1778.1; Rüppell, W. P. 1829.1, 1830.1, 1836.1; Werner, Franz. 1906.1; *Early ref.* Herodotus, — Pre-Linn. 1709.1.

Nyassa, Lake: Boulenger, G. A. 1897.3, 1898.12, 1902.14, 1908.3; Günther, A. 1864.14; Keilhack, F. 1908.1, 1910.1.

Red Sea: Borsieri, C. 1904.1; Giglioli, E. H. 1888.1; Geoffroy-St.-Hilaire, I. 1827.1; ★Klunzinger, C. *General treatise*, 1884.1, *Varia*, 1870.1–1871.2, 1872.1, 1877.1, 1878.1; Kossmann, R. 1877.1, 2, 1879.1; Kossmann, R., & Räuber, H. 1877.1; Pellegrin, J. 1912.8; Picaglia, L. 1894.1; Rüppell, W. P. 1826.1 (*General treatise*); Steindachner, F. 1898.2, 3, 1902.3. — *Intrusion into Suez canal*. Tillet, M. 1913.1; Krukenberg, C. F. Add. 1882.1.

Rhodesia, or British Central Africa: Boulenger, G. A. 1896.3, 1903.3, 1907.3, 9, 1912.5, Add. 1914.3, *Mashonaland* 1902.22, 1911.4, *Bangweolo, Lake*. 1905.8, 1912.5; Günther, A. 1893.2. — *Works of travel, etc.* Johnston, H. H. 1897.1; Livingstone, D. Add. 1858.1, 1874.1. — See also Zambesi R.

Sahara: *Chiefly fauna of artesian wells.* Blanc, E. 1895.1; Desor, P. J. 1864.1; Gogorza, J. 1886.1; Pellegrin, J. 1909.4, 1911.8, 1914.11; Rolland, G. F. 1881.1, 1895.1; Tristram, H. B. 1859.1. — *Marine fauna.* Vinciguerra, D. 1890.2. — *Coast between C. Blanco and C. Verde.* Pellegrin, J. 1905.4, 5, 1908.6, 1909.11.

Senegal: *Fresh-water fauna.* Steindachner, F. 1870.6. — *Casamance R.* Pellegrin, J. 1904.1, 1911.6. — *Senegal R.* Perugia, A. 1892.2; Rochebrune, A. T. 1880.1, 1883.1. — *Marine fauna.* Bennett, E. T. 1831.1; Pellegrin, J. 1905.4, 5, 1908.6, 1909.11. — *Gorée.* Steindachner, F. 1870.6, 1882.1, 2. — *Early nat. hist.* Adanson, M. Pre-Linn. 1749.1.

Sierra-Leone: Boulenger, G. A. 1911.6; Lütken, C. F. 1874.1 (v), 1877.3; Poche, F. 1902.3. — *Early ref.* Prévost, A. F. Pre-Linn. 1747.1.

Somaliland, French: *Obok.* Pellegrin, J. 1904.10, 1906.15. — *For Gulf of Aden, see Arabia under Asia.*

Somaliland, Italian: *Fresh-water fauna.* Boulenger, G. A. 1903.15, (*Webi*) *Shebeli R.*; Meek, S. E. 1899.1; Senna, A. 1915.1; Vinciguerra, D. 1897.1, 1913.1, *Ganana R.* 1895.2, 1897.2, 1898.1, *Marine fauna at Obbia.* 1893.1.

South-West Africa, German: *Fresh-water fauna.* Dove, K. 1896.1; Günther, A. 1877.4 (*Buffalo R.*); Pappenheim, P. 1910.1.

Sudan; see also Niger R. and Nigeria. Kammerer, P. 1906.3; Pellegrin, J. 1906.11; Vaillant, L. 1896.4.

Tanganyika, Lake: Boulenger, G. A. 1898.15, 1899.14, 1900.8, 1901.10, 23, 1906.6, Add. 1914.4; Burton, R. F. 1860.1; Günther, A. 1893.1; Moore, J. E. 1898.1, 1902.1; Pellegrin, J. 1908.4; Steindachner, F. 1909.2, 3, 4, 7, 1911.1; Vaillant, L. 1899.3.

Transvaal: *Fresh-water fauna.* Boulenger, G. A. 1907.2, 10, 11; Methuen, P. A. 1913.1.

Tripoli: *Littoral fauna.* Pietschmann, V. 1906.1; Vinciguerra, D. 1883.2.

Tunis: *Fresh-water fauna.* Blanc, E. 1895.1; Vaillant, L. 1904.3. — *Marine fauna.* Chaignon, H. 1904.1; Pietschmann, V. 1906.1; Vinciguerra, D. 1883.2, 1884.1; Vaillant, L., & Pellegrin, J. Add. 1908.1.

Vaal R.: Boulenger, G. A. 1901.4.

West Africa, French; see Nigeria, Niger River, Senegal and Sudan.

West Africa, Portuguese: (Angola). *Fresh-water fauna.* Boulenger, G. A. 1904.4, 1905.4, 1906.4, 10, 1907.6, 10, 1910.4, 1911.7, 1913.4; Capello, F. 1871.1; Günther, A. 1873.4; Guimarães, A. R. 1884.1, 1885.1, *List.* 1882.2; Peters, W. C. 1844.1; Regan, C. T. 1905.4; Steindachner, F. 1866.7. — *Marine fauna.* Osorio, B. 1892.1, 1898.1, 1906.1; Pellegrin, J. 1912.7, 13.

Zambesi R.: *see also Rhodesia.* Boulenger, G. A. 1896.4 (*List*), 1905.2, 1908.4, 1912.5; Günther, A. 1864.14; Pellegrin, J. 1914.4; Peters, W. C. 1872.1.

Zanzibar: (I.), chiefly marine. Brauer, A. 1902.1; Fowler, H. W. 1903.4; Günther, A. 1868.1, 1869.2, 1873.3; Peters, W. 1868.4; Pfeffer, G. J. 1889.1; Playfair, R. L. 1866.1, 1869.1; ★Playfair, R., & Günther, A. 1866.1 (*General treatise*); Steindachner, F. 1866.17, 1867.1.

AMERICA

NORTH AMERICA

General treatises

The Fishes of North and Middle America.

★Jordan, D. S., & Evermann, B. W.

Fauna — Cont'd.

1896.2. — *Review of this work.* Cope, E. D. 1897.1. — *Fishes of North America.* Girard, C., Suckley, G., & Agassiz, L. 1857.1. — *Catalogues.* Forster, J. R. 1771.1; Gill, T. N. (*East Coast*) 1862.2, 1873.1, 1878.1; Jordan, D. S. 1887.1. — *Check-list.* Jordan, D. S., & Evermann, B. W. 1896.1. — *Synopsis.* Jordan, D. S., & Gilbert, C. H. 1883.25; Storer, D. H. 1846.1. — *Range of certain fishes on the Atlantic coast of the United States.* Kendall, W. C. & Smith, H. M. 1895.1, 1897.1.

Popular general treatises

American food and game fishes. ★Jordan, D. S., & Evermann, B. W. **1902.1.** — *Other treatises.* ★Goode, G. B. 1879.5, 1884.4, **1888.1**, 1903.1; Harris, W. C. 1888.1, 1908.1; Holder, C. F. 1903.1; Roosevelt, R. B. 1862.1, 1865.1, 1884.1; Shields, G. O. 1892.1. — *Manual of vertebrates.* Jordan, D. S. 1876.2, 1878.5, 1885.9, 1888.4, 1899.2.

Fresh water fauna

Catalogue. Jordan, D. S. 1878.3. — *Check-list.* Jordan, D. S., & Copeland, H. E. 1877.1. — *Origin.* Palacky, J. 1861.1, 1895.1.

ALASKA

General: Bean, T. H. 1881.8 (*List*); ★Evermann, B. W., & Goldsborough, E. L. **1906.2.** **Fresh-water fauna:** Bean, T. H. 1884.3, 1885.5, 1888.1; Chamberlain, F. M. 1907.1; Evermann, B. W. 1904.7; Fowler, H. W. 1905.3; Nichols, J. T. 1908.2. **Marine fauna (chiefly).** Bean, T. H. 1878.3, 7, 1879.4, 8, 10, 1881.1, 5, 8, 1883.2, 6, 1885.2, 1887.8, 1889.5, 1890.19, 31, 1894.3; Bean, T. H., & Bean, B. A. 1898.1; Cope, E. D. 1873.1; Gilbert, C. H. 1889.1; Jordan, D. S. 1903.4; Kittlitz, F. H. 1858.1; Kumlien, T. L. 1879.1; Lockington, W. N. 1880.2, 6; Murdoch, J. 1885.1, 2; Nelson, E. W. 1887.1; Pallas, P. S. 1811.1; Scofield, N. B. 1899.1; Turner, L. M. 1886.1. **Aleutian Is.:** Turner, L. M. 1886.1. — *Bering I.* Ehrenbaum, E. 1905.1; Henking, H. 1901.2; Lönnberg, A. J. 1901.1. **Bering Sea and Straits:** Beechey, F. W. 1839.1; Evermann, B. W. 1892.3; Gilbert, C. H. 1895.1; Gilbert & Burke, C. V. 1912.1; Gill, T. N. 1860.6; Gill & Townsend, C. H. 1897.1; ★Jordan, D. S., & Gilbert, C. H. **1899.1**; Smith, H. M. 1904.9. — *Pribilof Is.* Elliott, H. W. 1881.1. **Kadiak I.** Rutter, C. M. 1899.1.

CANADA**General treatises**

Check lists. Evermann, B. W., & Goldsborough, E. L. 1907.1; ★Halkett, A. **1913.1.** — *Popular treatises.* Gosse, P. H. 1840.1; Johnson, F. M. 1902.1; Montpetit, A. N. 1897.1. — *Catalogue.* Whiteaves, J. F. 1886.1. — *Fauna Boreali-Americana.* Richardson, J. 1831.1, 1837.1.

Miscellanea

Adams, A. L. 1873.1; Blakiston, T. 1857.1; De la Roche, J. F. 1812.1; Eig-

enmann, C. H. 1892.4, 1894.5; Jeffreys, T. 1760.1; Lesueur, C. A. 1819.1; — *Various bibliographical data.* (1900–1912) Walker, E. M. 1914.1; Whiteaves, J. F. 1901.1–1907.1; Anon. 147.

Alberta: (*Prov.*), *Calgary.* Eigenmann, C. H., & Eigenmann, R. S. 1892.3.

Assiniboia: (*Prov.*). Eigenmann, C. H., & Eigenmann, R. S. 1893.1.

Athabasca: (*Prov.*). Preble, E. A. 1908.1.

Barrow Straits: Sutherland, P. C. 1852.1.

British Columbia: *Marine fauna, chiefly.* Babcock, J. P. 1908.1; Bean, T. H. 1881.5, 1883.6, 1890.30; Green, A. 1891.1, 2; Lord, J. K. 1866.1; Murphy, J. M. 1874.1, 2, 1877.1; Timbs, J. 1869.1. — *Fresh-water fauna.* Brew, C. 1861.1; Eigenmann, C. H., & Eigenmann, R. S. 1892.3; Jordan, D. S. 1889.6, 1894.1; Jordan, D. S., & Snyder, J. O. 1908.2. — *Kamloops Lake.* Jordan, D. S. Add. 1892.2. **Queen Charlotte I.** Gilbert, C. H. 1895.1. **Vancouver I.;** *chiefly marine.* Gilbert, C. H. 1895.1, Add. 1912.1; Günther, A. 1866.2; Jordan & Gilbert. 1882.1; Lord, J. K. 1866.1; Peters, W. C. 1872.2. — *Fresh-water at Nanaimo.* Jordan, D. S. 1904.3.

Hudson Bay: Bean, T. H. 1881.6; Forster, J. R. 1773.1; Halkett, A. 1897.1, 1905.1; Schwatka, F. 1885.1; Wales, W. 1770.1.

Labrador: *Fresh-water fauna.* Kendall, W. C. 1909.1, 1910.3; Stearns, W. A. 1883.1. — *Marine fauna, chiefly.* Cormack, W. E. 1832.1; Packard, A. S. 1866.1, 1891.1; Stearns, W. A. 1883.1 (*Cape Breton*); Storer, H. R. 1857.1; Weiz, S. 1864.1.

Mackenzie: (*Prov.*). Gilbert, C. H. 1895.2; Preble, E. A. 1908.1.

Manitoba: (*Prov.*), *Winnepeg.* Eigenmann, C. H., & Eigenmann, R. S. 1892.3, 1893.1.

New Brunswick: Bean, T. H. 1879.1, 6; Cox, P. 1893.1; Gill, T. N. 1865.13 (*Bay of Fundy — Synopsis*); Lamothe-Cadillac, — 1855.1 (*St. John R.*); Lanman, C. 1874.1, 2, 3. — *Game fishes, general treatises.* Roosevelt, R. B. 1862.1, 1865.1, 1884.1. — *Catalogues.* Perley, M. H. 1851.1, 1852.1; Cox, P. Add. 1896.1–1905.1.

Newfoundland: *Chiefly marine.* Atwood, N. E. 1861.1; Cormack, W. E. 1832.1; Filleau, A. 1850.1 (*Miquelon and St. Pierre Is.*); Gilbert, C. H. 1913.1; Goode, G. B. 1879.11, 1881.17; ★Halkett, A. **1913.1** (*Check-list*); Harvey, M. 1877.1, 1880.1.

Nova Scotia: *Chiefly marine fauna.* — *Lists.* Jones, J. M. 1879.1, 1882.1. — *Catalogues.* Knight, T. F. 1866.1; Perley, M. H. 1851.1, 1852.1. — *Various localities, chiefly Halifax and St. George's Banks.* Ambrose, J. 1867.1–1890.1, Add.

1864.1 (*St. Margaret's Bay*); Bean, B. A. 1889.9; Cornish, G. A. 1907.1; Fletcher, H. 1878.1 (*Bras d'Or Lakes*); Gilpin, J. B. 1874.1; Goode, G. B. 1878.8; Goode, G. B., & Bean, T. H. 1878.2, 1879.7; Honeyman, D. 1886.1; Jones, J. M. 1865.1, 1867.1, 1874.2, 1878.2; Lanman, C. 1874.1-1874.3; Pickles, H. 1902.1; Piers, H. 1890.1, 1892.1, 1899.1; Reid, A. P. 1877.1; Storer, H. R. 1857.1.

Ontario: (*Prov.*). Halkett, A. 1902.1, 1905.2; Meek, S. E. 1899.3 (*Muskoka Lake*); Meek, S. E., & Clark, H. W. 1902.1; D'Urban, W. S. 1858.1; Barlow, A. E. Add. 1899.1 (*Nipissing and Temiscaming region*); Nash, C. W. Add. 1908.1, 1913.1.

Prince Edward I.: *Tignish*. Cornish, G. A. Add. 1912.1.

Quebec: (*Prov.*). Bean, T. H. 1890.39 (*Metabetchouan R.*); Boardman, G. A. 1875.1 (*Saguenay R.*); Chambers, E. T. 1911.1; Cox, P. 1900.1; Gill, T. N. 1858.3 (*St. Catherine*); Huard, V. A. 1900.1, 2 (*Saint-Jean Lake*); D'Urban, W. S. 1858.1. **Anticosti I.** Schmitt, J. Add. 1904.1; Whiteaves, J. F. Add. 1872.1, 1873.1, 1874.1.

St. Lawrence: (*Gulf and River*). — *List*. Evermann, B. W., & Kendall, W. C. 1902.2. — *Synopsis*. Gill, T. N. 1865.13. — *Various papers*. Fortin, P. 1863.1, Add. 1864.1; Austin, F. W. Add. 1866.1; Bell, R. Add. 1859.1. — *Early natural history refs. in Pre-Linn. section*. Boucher, P. 1664.1; Charlevoix, P. F. 1744.1; La Hontan, J. 1703.1.

Yukon: Bean, T. H. 1888.3; Dawson, G. M. 1887.1.

GREAT LAKES

General

List of species. Evermann, B. W. 1902.13. — *Salmonoid fishes, review*. Jordan, D. S., & Evermann, B. W. 1911.1. — *Plan for study*. Reighard, J. E. 1900.4. — *See also fauna of surrounding regions*.

Lake Erie: Kirtland, J. P. 1844.4.

Lake Michigan: Hoy, P. R. 1870.1; Jordan, D. S., & Gilbert, C. H. 1883.7; Stimpson, W. 1870.1; Ward, H. B. 1896.1.

Lake Ontario: Agassiz, J. L. 1856.4, 1857.1; Evermann, B. W., & Kendall, W. C. 1901.1; Green, S. 1874.12; Jordan, D. S., & Thompson, W. F. 1910.1. — *Ancient fish-banks assumed to indicate former greater extent of Lake Ontario*. Anon. 45.

Lake Superior: Agassiz, J. L. 1848.5, 7, 9; Agassiz, J. L., & Cabot, J. E. 1850.1; Barnston, G. 1874.1; Jordan, D. S. 1885.16; Roosevelt, R. B. 1865.2, 1884.2; Ruthven, A. G. 1906.1 (*Isle Royale*); Tomlin, W. D. 1888.1; Jackson, C. T. Add. 1844.1. — *For a general bibliography of Lake Superior and environs, see Hankinson, T. L. in Pub. 20 (Biol. Ser. 4) p. 159, of Michigan Geol. and Biol. Survey, 1916.*

GREENLAND

General: Fabricius, O. 1780.1. — *Catalogue*. Lütken, C. F. 1875.3. — *List*. Reinhardt, J. T. 1857.1. — *Works of travel with incidental faunal references*. Blakiston, T. 1857.1; Cranz, D. 1767.1; Graah, W. A. 1837.1. — *References in Pre-Linn. Section*. Egede, H. 1738.1-1746.1; Magnus, O. 1599.1; Prévost, A. F. 1747.1. **Marine fauna:** (*chiefly*). Bean, T. H. 1879.1, 6 (*Disko Bay*); Brown, Robert, 1877.1; Collett, R. 1887.1; Dallas, W. S. 1872.1; Dresel, H. G. 1885.2; Etzel, A. 1860.1; Fabricius, O. 1793.1, 1797.1; Feilden, H. W. 1878.1 (*Smith Sound*); Günther, A. 1875.1; Jensen, A. S. 1904.1, 2; Johansen, Fr. 1906.1; Jones, T. R. 1875.1; Koefoed, E. 1909.2; Kroyer, H. N. 1837.2, 3, 1845.9, 10, 1861.1; Lütken, C. F. 1876.1, 1877.2, 1896.1, 1898.1; Mandt, M. W. 1822.1; Nordenskiöld, A. 1885.1; Reinhardt, J. C. 1834.1, 1836.1, 1837.3, 1838.1, 1839.1, 1841.1, 1842.1, 1844.1; Scoresby, W. 1823.1; Tréhouart, F. T. 1838.1; Vanhöffen, E. 1897.1; Gaimard, P. Add. 1838.1.

GULF OF MEXICO

Bean, T. H. 1889.4, 1892.2; Bean, T. H., & Bean, B. A. 1894.1; Bean, T. H., & Dresel, H. G. 1895.1; Goode, G. B. 1878.11; Goode, G. B., & Bean, T. H. 1879.1; Jordan, D. S. 1888.1, 2; Parra, D. A. 1787.1. — *See also under surrounding regions*.

UNITED STATES

General

For comprehensive works on the fishes of North America, inclusive of the United States, see General treatises at the beginning of this section on America.

Distribution. Jordan, D. S. 1878.8. — *Index and list of the principal rivers of the United States*. Smiley, C. W. 1884.1, 9. — *List of the principal lakes*. Smiley, C. W. 1884.8.

Western States, Pacific Coast, etc., including both fresh-water and marine faunas. Agassiz, J. L. 1855.1; Eigenmann, C. H. 1894.5; Gill, T. N. 1862.10, 1864.15, 22, 1866.1, 1882.1; Girard, C. F. 1857.7; Rafinesque, C. 1818.4-7; Rutter, C. M. 1896.1; Steindachner, F. 1877.1 (iv). — *Catalogue, fishes of Pacific coast, north of Cerros I.* Eigenmann, C. H., & Eigenmann, R. S. 1892.1.

Alabama: *Fresh-water fauna*. Agassiz, J. L. 1854.3 (*Tennessee R.*); Bollman, C. H. 1887.1 (*Escambia R.*); Gilbert, C. H. 1888.1, 1891.3. — *Marine fauna*. Smith, H. M. 1899.5; Storer, D. H. 1844.6, 1848.4, 5.

Arizona: Baird, S. F., & Girard, C. 1853.3, Add. 1854.1 (*Zuni R.*); Cope, E. D. 1874.9, 1876.3; Cope, E. D., & Yarrow, H. C. 1875.1; Emory, W. H. 1848.1 (*Gila R.*); Gilbert, C. H., & Scofield, N. B. 1898.1; Kirsch, P. H. 1889.1 (*Fort*

Fauna — Cont'd.

Thomas); Yarrow, H. C. 1875.1; Yarrow, H. C. & others. 1875.1.

Arkansas: *Catalogue.* Meek, S. E. 1891.1. — *Other papers.* Baird, S. F., & Girard, C. 1853.1; Fowler, H. W. 1904.7; Gilbert, C. H. 1888.1, 1889.3; Girard, C. F. 1858.2, 1859.1; Jordan, D. S., & Gilbert, C. H. 1887.1; Meek, S. E. 1891.3, 1895.2-1896.1.

California: *Fresh-water fauna.* Ayers, W. O. 1860.1; Baird, S. F. 1873.37; Baird, S. F., & Girard, C. 1861.1; Caton, J. D. 1870.1; Cope, E. D., & Yarrow, H. C. 1875.1; Eigenmann & Eigenmann. 1888.1, 3, 1889.2, 4, 1891.2; Gilbert, C. H. 1893.1; Girard, C. F. 1856.4, 1857.3, 6; Jordan, D. S. 1884.2, 1893.1, 1894.2; Jordan & Grinnell, J. 1908.1; Jordan & Henshaw, H. W. 1878.1; Jordan & Richardson, R. E. 1907.1; Rutter, C. M. 1904.3; Saxe, — 1870.1; Snyder, J. O. 1908.5; Stearns, R. E. 1879.1; Thornton, J. Q. 1849.1; Yarrow, H. C. & others. 1875.1. — *Clear Lake, (List).* Jordan, D. S., & Gilbert, C. H. 1895.1. — *Fort Bidwell.* Cope, E. D. 1883.6. — *Kern R.* Heuresse, R. 1876.1; Jenkins, O. P. 1906.1; Jordan, D. S. Add. 1892.3. — *Klamath R.* Gilbert, C. H. 1898.1. — *McCloud R.* Campbell, J. B. 1882.1; Jordan, D. S. 1895.1. — *Mendocino (Co.).* Gibbons, W. P. 1876.1. — *Monterey.* Snyder, J. O. 1912.2. — *Mt. Whitney.* Evermann, B. W. 1904.3, 4, 1906.14. — *Sacramento R.* Baird, S. F. 1873.40; Gibbons, W. P. 1854.1; Jordan, D. S., & Gilbert, C. H. 1882.3; Rutter, C. M. 1908.1; — *Relation to fauna of Russian R.* Snyder, J. O. 1908.4. — *San Francisco.* Snyder, J. O. 1905.2. — *San Joaquin R.* Netherclift, W. 1876.1; Redding, B. B. 1876.1; Rutter, C. M. 1908.1. — *San Luis Obispo (Co.).* Jordan, D. S. 1895.4. — *Santa-Ana R.* Snyder, J. O. 1908.2. — *Lake Tahoe.* Juday, C. 1907.1; Snyder, J. O. 1912.4.

Marine fauna: (*chiefly*). — *Popular accounts.* Jordan, D. S. 1902.4; Payne, H. T. 1914.1. — *Various localities.* Agassiz, A. 1861.1; Alzate y Ramirez, J. 1772.1, 1773.1; Auteroche, C. 1778.1; Ayres, W. O. 1854.2-1863.1; Bean, T. H. 1893.1; Cooper, J. G. 1863.1-1868.3; Eigenmann, C. H. 1890.6, 1891.2, 1893.4; Eigenmann & Eigenmann. 1889.4; Eigenmann, R. S. 1891.1; Evermann, B. W., & Goldsborough, E. L. 1906.1; Forbes, A. 1839.1; Gilbert, C. H. 1890.3, 1892.2, 1895.1, 1897.1, 1899.1, 2, 1904.1; Gill, T. N. 1863.9, 1865.10; Girard, C. F. 1856.2, 4, 8, 1857.1, 2, 1858.2, 1859.1; Greeley, A. W. 1901.1; Hartley, F. 1895.1; Holder, C. F. 1900.2; Hooper, E. J. 1875.1; Jordan, D. S. 1906.2; Jordan, D. S., & Gilbert, C. H. 1880.2-1880.36, 1882.12, 1883.11, 1894.1; Lockington, W. N. 1877.1, 1879.2, 7-9, 1880.3, 5, 7; Ritter, W. E. 1902.1; Serre, P. 1901.1; Starks, E. C., & Mann, W. M. 1911.1; Starks & Morris, E. L. 1907.1; Storer, D. H. 1848.3; Swain, J. 1882.3; Venegas,

M. 1757.1, 1759.1; Hilton, W. A. Add. 1914.1. — *Channel Is.* Holder, C. F. 1910.1. — *Laguna Beach.* Metz, C. W. 1912.1. — *Monterey Bay.* Evermann, B. W. 1896.2; Jordan, D. S., & Gilbert, C. H. 1880.1, 3, 12, 16, 19, 25, 29; Meek, S. E., & Pierson, C. J. 1895.1; Snyder, J. O. 1908.3; Gilbert, C. H. Add. 1914.1; Jordan, D. S. Add. 1880.1. — *Santa Barbara.* Gill, T. N. 1865.2; Jordan, D. S. 1883.1; Yarrow, H. C. 1876.1, 1879.1; Yarrow, H. C., & Henshaw, H. W. 1878.1. — *Santa Catalina.* Jordan, D. S., & Gilbert, C. H. 1880.9; Jordan & Starks, E. C. 1907.3. — *San Diego.* Eigenmann, C. H. 1892.2, 6; Eigenmann & Eigenmann. 1889.1, 1890.1; Gilbert, C. H. 1890.2; Jordan, D. S., & Gilbert, C. H. 1880.31, 1883.4; Smith, R. 1880.1, 2, 1881.1, 2. — *San Francisco.* Gibbons, W. P. 1854.1; Girard, C. F. 1856.5; Murray, A. 1860.1.

Colorado: Byers, W. N. 1878.1, 2; Cockerell, T. D. 1908.1, 1911.2, 1912.1; Cope, E. D. 1874.9, 1876.3; Cope, E. D., & Yarrow, H. C. 1875.1; Jordan, D. S. 1891.5; Jordan & Evermann, B. W. 1890.1; Juday, C. 1904.1-1905.1. — *Twin Lakes.* Cope, E. D. 1875.9, 1876.3; Juday, C. 1907.2. — *General treatise.* ★Ellis, M. M. Add. 1914.1.

Colorado River: Baird, S. F., & Girard, C. 1853.3; Evermann, B. W., & Rutter, C. 1895.1; Ives, J. C., & Newberry, J. 1861.1; Snyder, J. O. 1915.1.

Connecticut: *Fresh-water fauna.* Ayres, W. O. 1849.2; Doolittle, A. A. 1908.1; Gladwin, C. O. 1876.1, 2, 3; Goode, G. B. 1871.1; Kendall, W. C., & Goldsborough, E. L. 1907.1; Linsley, J. H. 1844.1 (*Catalogue*); Morris, R. T. 1876.1 (*List*); Storer, D. H. 1844.5; Storer, H. R. 1854.1.

Delaware: Fowler, H. W. 1911.3, 1912.3; Fowler & Phillips, R. J. 1913.1.

District of Columbia: Bean, B. A., & Weed, A. C. 1911.4; Cope, E. D. 1869.2; Evermann, B. W. 1907.1; Gill, T. N. 1861.3; Keim, D. 1861.1; Smith, H. M. 1899.3; Smith, H. M., & Bean, B. A. 1899.1 (*List*); Weed, A. C. 1912.1.

Florida: *General treatises.* Catesby, M. 1771.1, 1777.1; Holbrook, J. E. 1847.1. — *Check list with bibliography.* ★Evermann, B. W., & Kendall, W. C. 1900.1. — *Catalogue.* Goode, G. B. 1879.14. — *Game fishes, sporting works, general natural histories, etc.* Clarke, S. C. 1876.2; Cory, C. B. 1896.1; Evermann, B. W. 1906.11, 15; Forbes, J. G. 1821.1; Holder, C. F. 1908.6; Romans, B. 1776.1; Turner-Turner, J. 1902.1; Van Doren, L. O. 1884.1; Williams, — 1839.1; Henshall, J. A. Add. 1884.1. **Fresh-water fauna:** Cope, E. D. 1877.6 (*Volusia*); Evermann, B. W. 1906.6; Evermann & Bean, B. A. 1896.1 (*Indian R.*); Evermann & Kendall, W. C. 1898.1; Goode, G. B. 1879.14 (*St. John's R.*); Hay, O. P. 1885.1; Heilprin, A. 1887.1; Holbrook, J. E. 1855.1; Jordan, D. S. 1880.1, 1881.2, 3.

1885.6; Jordan & Meek, S. E. 1885.3 (*Jacksonville*); Nichols, J. T. 1912.2; Woolman, A. J. 1892.3. **Marine fauna:** (*chiefly*). Adams, A. C., & Kendall, W. C. 1891.1; Baird, S. F. 1873.21; Bean, B. & Weed, A. 1911.1; Bean, T. H. 1885.9, 1890.11; Clarke, S. C. 1871.1, 1873.1, 1877.1, 3, 1884.1; Evermann, B. W. 1897.2; Fowler, H. W. 1903.1, 1906.7; Gill, T. N. 1864.3, 1866.2; Goode & Bean, 1878.3, 5, 9, 1879.2, 6, 1882.1, 1884.1; Gudger, E. W. 1913.4; Jordan, D. S. 1881.2, 3, 1884.3, 1885.5, 8, 1890.3; Jordan & Evermann. 1887.1; Lönnberg, A. J. 1894.3; Nichols, J. T. 1910.2, 1914.2, 4; Parker, G. H. 1904.3; Smith, H. M. 1904.7. — *Cedar Keys*. Jordan & Swain, J. 1885.3. — *Key West*. Gudger, E. W. 1913.1; Henshall, J. A. 1884.1, 1891.1, 1895.1; Jordan & Gilbert. 1885.2; Jordan & Swain. 1885.2; Nichols, J. T. 1914.1; Osburn, R. C. 1911.7, 1912.4; Poey y Aloy, F. 1883.1; Swain, J., & Meek, S. E. 1885.1, 2. — *Pensacola*. Cope, E. D. 1870.7; Dresel, H. G. 1885.1; Eigenmann, C. H. 1888.1; Jordan, D. S. 1885.12, 1887.6; Jordan & Gilbert. 1883.20, 1884.3; Jordan & Swain. 1885.1. — *Tortugas Is.* Gudger, E. W. 1913.5, Add. 1914.3; Holder, J. B. 1871.1; Jordan, D. S. 1904.4; Jordan & Thompson. 1905.1.

Georgia: *Chiefly fresh-water fishes.* Baird, S. F. 1873.39 (*Altamaha R.*); Bean, T. H. 1879.9; Gilbert, C. H. 1890.1; Holbrook, J. E. 1847.1 (*Gen. treat.*), 1855.1; Jordan, D. S. 1874.1 (*Synopsis*), 1880.1; Jordan & Brayton. 1878.1; Jordan & Meek. 1885.2.

Idaho: Bean, T. H. 1890.13; Bendire, C. E. 1878.1; Eigenmann, C. H., & Eigenmann, R. S. 1893.1; Evermann, B. W. 1895.1, 1896.3, 1897.5; Oreservoir, — 1879.1.

Illinois: *General treatises, catalogues, lists, etc.* Forbes, S. A. 1884.1; ★Forbes, S. A., & Richardson, R. E. 1908.1, 2; Jordan, D. S. 1878.1; Large, T. 1904.1; Meek, S. E., & Hildebrand, S. F. 1910.1; Nelson, E. W. 1876.1. — *Other papers.* Baker, F. C. 1910.1; Forbes, S. A. 1881.1, 1885.2, 1907.1, 1909.1, 1911.1, 1912.1; Garman, H. 1891.1; Hay, O. P. 1896.1; Hart, C. A., & Gleason, H. A. 1907.1; Jordan, D. S. 1880.1; Jordan & Gilbert. 1883.2; Kennicott, R. 1855.1; Locke, W. M. 1879.2; Richardson, R. E. 1913.1; Rock, F. 1876.1; Swain, J., & Kalb, G. B. 1882.1; Forbes, S. A., & Richardson, R. E. Add. 1913.1; Hankinson, T. L. Add. 1913.1.

Indian Territory: Fowler, H. W. 1904.7; Jordan, D. S., & Gilbert, C. H. 1887.1. — *List*. Meek, S. E. 1896.1.

Indiana: *Bibliography, catalogues, general treatises, lists, etc.* Eigenmann, C. H. 1894.1; ★Eigenmann, C. H., & Beeson, C. H. 1894.1, Add. 1905.1; ★Hay, O. P. 1895.2; Jordan, D. S. 1875.2, 1877.3, 1878.2; Jordan & Gilbert. 1877.1; Meek, S. E. Add. 1908.1. — *Various papers.*

Banta, A. M. 1907.1; Blatchley, W. S. 1896.1; Cope, E. D. 1871.5 (*Wyandotte Cave*); Eigenmann, C. H. 1894.1, 1896.2, 1902.8; Eigenmann & Fordice, M. 1886.1 (*Monroe Co.*); Evermann, B. W. 1886.1, 1887.1, 1888.1; Evermann & Clark, H. W. 1910.1 (*Cicott and Fletcher Lakes*); Evermann & Jenkins, O. P. 1888.2; Gilbert, C. H. 1885.2, 3; Hahn, W. L. 1908.1; Haseman, J. D. 1906.1; Hay, O. P. 1896.1 (*Lake Co.*); Jenkins, O. P. 1887.1 (*Vigo Co., List*); Jordan, D. S. 1890.4; Jordan & Evermann. 1886.1; Kirsch, P. H. 1895.1, 2 (*Eel and Maumee Basins*); Moenkhaus, W. J. 1895.1; Plummer, J. T. 1851.1; Ramsey, E. E. 1900.1 (*Winona Lake*); Ulrey, A. B. 1894.1; Swain, J. Add. 1884.1; Sweeney, Z. T. Add. 1905.1, 1906.1. — *Tippecanoe Lake*. Jordan, D. S. 1875.1; Jordan & Evermann. 1891.1; Moenkhaus, W. J. 1903.1; Voris, J. H. 1899.1. — *Lake Maxinkuckee*. Evermann, B. W. 1900.3. — *For an extensive treatise relating to Indiana fishes, see* ★Evermann, B. W., & Clark, H. W. — "Lake Maxinkuckee" in 2 vols. Pub. 7, Ind. Dept. of Conservation, 1920.

Iowa: Call, R. E. 1892.1; Jordan, D. S., & Meek, S. E. 1886.1; Meek, S. E. 1889.1, 1890.1, 1891.2, 1892.1. — *Lake Okoboji*. Nichols, J. T. 1916.2.

Kansas: Abbott, C. C. 1861.5, 7; Cope, E. D. 1865.3, 1871.18 (*Fort Riley*); Cragin, F. W. 1885.2 (*List*); Crèvecoeur, F. F. 1903.1, 1908.1; Evermann, B. W., & Fordice, M. W. 1886.1; Gilbert, C. H. 1884.1, 1885.1, 4, 1886.1, 1889.1; Hay, O. P. 1887.1; Lawrence. Snow, F. H. 1875.1; Ottawa. Wheeler, W. A. 1878.1.

Kentucky: *Lists.* Garman, H. 1894.1; Woolman, A. J. 1892.2. — *Various localities.* Boepple, J. F. 1912.1; Eigenmann, C. H. 1899.6; Gilbert, C. H. 1888.1; Girard, C. F. 1858.2, 1859.1; Jordan, D. S. 1880.1; Jordan & Swain, J. 1884.1 (*Cumberland R.*); Kirsch, P. H. 1892.1, 1893.1; Louisville. Putnam, F. W. 1874.11; Call, R. E. Add. 1896.1. — *Mammoth Cave*. Garman, H. 1892.1; Putnam, F. W. 1872.1, 2, 1875.1, 2, 1880.1; Taylor, J. E. 1873.1; Tellkamp, T. A. 1844.1; Thompson, W. 1844.1; Wilson, J. 1854.1; Anon. 248. — *For the blind fishes of Mammoth Cave, see* Amblyopsis and Typhlichthys.

Louisiana: *Fresh-water fauna.* Baird, S. F., & Girard, C. 1853.2 (*Red R.*); Dowler, B. 1855.1; Evermann, B. W. 1899.4; Evermann & Kendall, W. C. 1898.1; Hay, O. P. 1883.1; Jordan, D. S. 1885.7. — *Marine fauna.* Bean, T. H. 1883.5; Weymouth, F. W. 1910.1.

Maine: *General treatises.* Holmes, E. 1862.1; ★Kendall, W. C. Add. 1914.1. — *Fresh-water fauna.* Bean, T. H. 1879.3 (*Schoodic Lakes*), 1910.6; Girard, C. F. 1854.8, 1856.6; Hamlin, A. C. 1874.1; Kendall, W. C. 1895.1, 1896.1, 1904.3, 1905.1–1906.2, 1908.3; Lanman, C. 1874.1–3; Page, G. S. 1874.2; Putnam,

Fauna — *Cont'd.*

F. W. 1866.1 (*Richardson Lake*); Shufeldt, R. W. 1903.1; Holmes, E. Add. 1861.1. — *Marine fauna*. Carter, R. 1884.1; Gill, T. N. 1873.4; Hanna, S. W. 1883.1; Kendall, W. C. 1908.1 (*List*); Lee, L. A. 1880.1; Storer, D. H. 1848.2; Welsh, W. W. Add. 1914.1. — *Casco Bay*. Kingsley, J. S. Add. 1909.1; Lee, L. A. Add. 1885.1.

Maryland: *Lists*. McAtee, W. L., & Weed, A. C. 1915.1 (*Plummers I.*); Radcliffe, L., & Welsh, W. W. 1916.1 (*Seneca Cr.*); Uhler, P. R., & Lugger, O. 1876.1, 1878.1. — *Fresh-water fauna*. Cope, E. D. 1873.5; Evermann, B. W., & Hildebrand, S. F. 1910.1; Fowler, H. W. 1912.3; Radcliffe, L., & Welsh, W. W. 1913.1; Smith, H. M. 1892.1. — *Marine fauna*. *Cape Charles*. Ryder, F. W. 1882.1; *Chesapeake Bay*. Bean, T. H. 1883.8; Collins, J. W. 1882.2, 1884.6; Evermann, B. W., & Hildebrand, S. F. 1910.1; Goode, G. B., & Bean, T. H. 1881.2; Kendall, W. C. 1914.3; *Ocean City*. Fowler, H. W. 1914.8.

Massachusetts: *History, catalogues, general treatises, etc.* Emmons, E. 1833.1; Gill, T. N. 1904.8; ★Goode, G. B., & Bean, T. H. 1879.3; ★Kendall, W. C. 1908.1; Smith, J. V. C. 1833.1–1843.1; ★Storer, D. H. 1839.3, 4, 1855.1, 1867.1. — **Fresh-water fauna.** Binney, A. 1840.1; Cutler, M. 1898.1; Fiske, — 1792.1; Gill, T. N. 1864.12; Putnam, F. W. 1856.1, 1869.1, 1870.3, 7, 1872.7, 1873.2, Add. 1875.1; Storer, D. H. 1837.2, 3, 1839.1–4, 1840.1, 2, 1843.3, 1844.1, 8; Sturtevant, E. L. 1874.1, 1876.1; Thoreau, H. D. 1868.1. **Marine fauna.** Atwood, N. E. 1864.1; Baird, S. F. 1871.5; Bean, B. A. 1898.2; Binney, A. 1840.1, 1842.1; Blake, J. H. 1870.1; Cabot, S. 1848.1; Gilbert, C. H. 1913.1; Gill, T. N. 1865.4, 1873.5, Add. 1872.1; Girard, C. F. 1856.3; Goode, G. B. 1878.7; Goode & Bean 1878.8; Jackson, J. B. 1848.2; Kendall, W. C. 1912.1; Kneeland, S. 1877.1; Lewis, A., & Newhall, J. B. 1865.1; Luce, T. R. 1883.1; Nye, W. 1883.1; Oakes, O. H. 1877.1; Pearse, A. S. 1913.1; Pease, J. C. 1873.1; Putnam, F. W. 1856.1, 1870.5, 1874.10; Rathbun, R. 1880.1; Storer, D. H. 1837.2–1839.4, 1843.1–1844.1, 9, 17, 18, 1848.6, 10, 15, 1851.1, 2, 3, 1856.1, 1859.1. — *Early ref.* Josselyn, J. Pre-Linn. 1672.1. — *Nantucket I.* Jackson, C. T. 1857.1; Putnam, F. W. 1870.1, 1871.2; *Synopsis*. Sharp, B., & Fowler, H. W. 1904.1. — *Martha's Vineyard*. Kendall, W. C. 1911.1; Thompson, J. H. 1882.1; Verrill, A. E. 1873.1, 1881.1. **Woods Hole;** *Lists*. Baird, S. F. 1873.21; ★Smith, H. M. 1898.1; Sumner, F. B., Osburn, R. C., & Cole, L. J. 1913.1. — *Other papers*. Bean, T. H. 1884.6; Lyman, T. 1872.1 (*Waquoit Wier*); Mead, A. D. 1898.1; Sherwood, G. H., & Edwards, V. N. 1902.1; Smith, H. M. 1898.2, 1899.2, 7, 1902.1, 9; Swain, J., & Meek, S. E. 1885.1; Thompson, M. T. 1899.1.

Michigan: Baird, S. F. 1875.15; Bissell, J. H. 1893.2; Bollman, C. H. 1891.1; Evermann, B. W. 1907.6; Hankinson, T. L. 1906.1–1911.1 (*Walnut Lake*); Heimbürger, H. V. 1913.1; Leathers, A. L. 1911.1 (*Saginaw Bay*); Norman, — 1875.1; Reighard, J. E. 1894.1 (*St. Clair Lake*); Ruthven, A. G. 1906.1 (*Isle Royale*); Schaffner, D. C. 1902.1; Strang, J. J. 1855.1; Tomlin, W. D. 1879.1. — *Catalogue*. Michael, E. L. 1906.1; "Partial catalogue." Cope, E. D. 1864.2. — *For review and extension of this work, see* ★Fowler, H. W. in Univ. of Michigan, Occ. Papers Mus. of Zool., no. 60, 1918.

Minnesota: Clarke, S. C. 1878.1; Cox, U. O. 1896.1; Evermann & Latimer 1910.1 (*Lake of the Woods*); Girard, C. F. 1858.2, 1859.1; Head, J. F. 1856.1; Suckley, G. 1860.1; Wagner, G. 1908.1, 1910.3; Woolman, A. J. 1895.2. — *General treatise*. ★Cox, U. O. Add. 1897.1.

Mississippi: Baird, S. F. 1873.2; Evermann, B. W. 1899.4; Eyrich, G. C. 1877.1; Hay, O. P. 1881.1, 1883.1; Jordan, D. S. 1885.1.

Mississippi River: Bean, T. H. 1879.2, 1884.8; Beard, D. C. 1878.1; Forbes, S. A., & Richardson, R. E. 1905.1; Husakof, L. 1910.5, 1911.3. — *Lake Pepin*. Clarke, S. C. 1878.1; Wagner, G. 1908.1.

Missouri: Call, R. E. 1887.1; Eigenmann, C. H. 1899.6; Evermann, B. W., & Cox, U. O. 1896.2; Evermann & Kendall, W. C. 1895.1; Evermann & Scovell, J. T. 1895.1; Garman, S. 1889.1; Gilbert, C. H. 1888.1; Jordan, D. S., & Meek, S. E. 1886.1; Meek, S. E. 1891.3, 1894.1.

Montana: Bickford, W. M. 1914.1; Cooper, J. G. 1870.1; Cope, E. D. 1879.2 (*Fort Benton*); Elrod, M. J. 1902.1; Evermann, B. W. 1893.1, 1897.3; Head, J. F. 1874.1; Henshall, J. A. 1906.1 (*List*); Jordan, D. S. 1878.10; Milner, J. W. 1874.2, 3; Scott, G. 1875.1.

Nebraska: Girard, C. F. 1858.2, 1859.1; Meek, S. E. 1895.1; Suckley, G. 1860.1.

Nevada: Cope, E. D. 1883.6 (*Pyramid Lake*); Cope & Yarrow, H. C. 1875.1; F., G. A. 1875.1; Gilbert, C. H. 1893.1; Jordan, D. S., & Henshaw, H. W. 1878.1; Yarrow, H. C., & others, 1875.1.

New Hampshire: *Fresh-water fauna*. Bean, T. H. 1884.1, 1886.2, 1887.6, 1889.26; Hatch, T. E. 1874.1 (*Monadnock Lake*); Jordan, D. S. 1879.3; Kendall, W. C. 1908.1 (*List*); Peck, W. D. 1804.1. — *Squam Lake*. Storer, H. R. 1859.1. — *Sunapee Lake*. Evermann, B. W. 1906.12, 1907.3; Kendall, W. C. 1913.1; Quackenbos, J. D. 1893.1, 1896.1. — *Winnipissee Lake*. Messenger, E. M. 1879.1; Prescott, W. 1851.1; Storer, D. H. 1844.5, 1844.11.

New Jersey: *General treatises*. Abbott, C. C. 1868.1; ★Fowler, H. W. 1906.3, 1907.6, 1908.1. — *Fresh-water fauna*. Abbott, C. C. 1861.3, 1871.1–3.

1873.1, 1874.4, 1875.1, 2, 1878.1; Cope, E. D. 1884.3; Fowler, H. W. 1904.3, 1907.2, 1914.7. — *Marine fauna*. Baird, S. F. 1855.1, 1856.1, 1857.1; Bean, T. H. 1888.5; Cope, E. D. 1870.2; Fowler, H. W. 1903.8, 1906.9, 1909.2-6, 1910.2, 1912.3, Add. 1914.2; Fowler & Phillips 1910.1; Lesueur, C. A. 1822.1; Moore, H. F. 1894.1; Osburn, R. C. 1910.6, 1911.9; Phillips, R. J. 1914.1; Shields, S. A. 1879.1; Smith, H. M. 1894.1; Van Mater, J. H. 1884.1.

New Mexico: Baird, S. F., & Girard, C. 1855.2; Cockerell, T. D. 1904.1; Cope, E. D., & Yarrow, H. C. 1875.1; Girard, C. F. 1858.1, 1859.3; Yarrow, H. C., & others, 1875.1.

New York: *General treatises, lists, etc.* Baird, S. F. 1856.1; 1857.1; ★Bean, T. H. 1902.1, 1903.1; ★Dekay, J. E. 1842.1-1855.1; Gill, T. N. 1857.1; Mitchill, S. L. 1814.1-1817.1, 1898.1; Nichols, J. T. 1913.2. — "*Edible fishes*." Pell, R. L. 1859.1. — *See also* ★Nichols & Gregory, "*Fishes of the vicinity of New York City*." Handbook 7, American Museum of Natural History, 1918. **Fresh-water fauna.** Baird, S. F. 1856.1; Bean, T. H. 1884.7, 1889.24, 1897.2, 1901.1, 1902.1, 1903.1, 1905.1; Bussell, -. 1880.1; Clapham, T. 1879.1; Clinton, D. W. 1815.2-1824.1; Evermann & Goldsborough, 1902.2; Fowler, H. W. 1914.5; Mather, F., & Dean, B. 1889.1; Pierce, J. 1820.1; Smith, Eugene. 1888.1. — *Adirondack region*. Mather, F. 1886.3, Add. 1890.1; Quid. 1877.1; Sherrill, C. A. 1899.1. — *Catskill region*. Alerton, W. S. 1876.1; Mearns, E. A. 1898.1, 2. — *Cayuga Lake*. Gage, S. H. 1878.1, 1911.1; Gage & Meek. 1886.1; Meek, S. E. 1886.1-1888.1. — *General treatise*. Reed, H. D., & Wright, A. H. 1909.1. — *Lake Champlain*. Evermann, B. W., & Kendall, W. C. 1902.1; Merriam, C. H. 1884.1; Watson, W. C. 1876.1, 1877.1. — *Hudson R.* Baird, S. F. 1873.36; Brunt, C. 1878.1; Fisher, A. K. 1891.1; Manhattan. 1877.2. **Marine fauna:** *chiefly of Long Island*. Akerly, S. 1843.1; Ayres, W. O. 1842.1, 2, 1843.2, 1848.6; Baird, S. F. 1855.1, 1856.1, 1857.1; Bean, T. H. 1884.5, 1885.8, 1887.9, 1890.5, 23, 1897.2, 1901.1, 1902.1, 1903.1, 2, 1905.1; Davenport, C. B. 1908.1; Fowler, H. W. 1912.3; Gregory, W. K., & Nichols, J. T. 1915.1; Hallock, C. 1873.7; Hussakof, L. 1915.1; Murphy, R. C., & Harper, F. 1915.1; Nichols, J. T. 1916.4, 8; Nichols & Murphy. 1916.1; Nichols & Wiegmann, W. H. 1914.1, 1915.1; Osburn, R. C. 1911.12; Quackenbush, L. S. 1906.1; Scott, G. G. 1900.1; Verrill, A. E. 1871.1; Wiegmann, W. H. 1914.1.

North Carolina: *General treatises.* Catesby, M. 1771.1, 1777.1; Cope, E. D. 1870.6; ★Smith, H. M. 1907.1. — *Review of this work*. Pratt, J. H. 1907.1. — *Early natural histories in Pre-Linn. section*. Brickell, J. 1737.1; Catesby, M. 1731.1; Lawson, J. 1709.1. — *Fresh-water fauna*. Bean, B. A. 1903.1; Bean, T. H.

1885.11; Buncombe, -. 1874.1; Cope, E. D. 1871.10; Evermann, B. W. & Cox, U. 1896.1 (*Neuse R.*); Jordan, D. S. 1890.4; Nichols, J. T. 1911.1. — *Lake Mattamuskeet*. Smith, H. M. Add. 1901.1. — *Marine fauna, chiefly at Beaufort*. Bean, T. H. 1880.2; Bickmore, A. S. 1865.1; Coles, R. J. 1910.1, 1913.1; Gill, T. N. 1864.4; Gudger, E. W. 1905.4, 1910.3, 1912.2, 1913.2, 3; Jenkins, O. P. 1885.1, (List) 1887.2; Jordan, D. S. 1881.1, (List) 1887.5; Jordan & Gilbert, C. H. 1878.1; McGlone, B. 1908.1; Nichols, J. T. 1914.3, 1916.6; Radcliffe, L. 1914.2, 1916.1, 1917.1; Smith, H. M. 1893.3, Add. 1905.2; Wilson, H. V. 1900.1; Yarrow, H. C. 1872.1, 1874.1, 2, 1877.1.

North Dakota: Cope, E. D. 1879.2; Jordan, D. S. 1878.10; Woolman, A. J. 1895.2. — *Devil's Lake*. Lord, H. W. 1884.1; Pope, T. E. 1908.1.

Ohio: *Catalogues, lists, etc.* Jordan, D. S. 1882.2, Add. 1877.1; ★Osburn, R. C. 1901.1; Storer, D. H. 1848.9; Klippart, J. H. Add. 1876.1. — *Various papers*. Baird, S. F. 1876.19; Cope, E. D. 1873.6; Henshall, J. A. 1888.1, 1890.1; Kirsch, P. H. 1895.2; Kirtland, J. P. 1838.1, 1840.1-3, 1844.2-4, 1848.1, Add. 1850.1; McCormick, L. M. 1890.1-1892.1 (*Lorain Co.*); Meek, S. E. 1889.2, 1895.1; Osburn, R. C., & Williamson, E. B. 1898.1, 1899.1 (*Franklin Co.*); Parker, J. B., Williamson & Osburn 1899.1; Sterling, E. 1874.1; Williamson, E. B. 1901.1.

Ohio River: "*Ichthyologia Ohiensis*." Rafinesque, C. 1820.2. — *Discussion of this*. Jordan, D. S. 1876.1. — *Other papers*. Cabot, S. 1848.2; Evermann, B. W. 1902.5; Hobbs, O. 1882.1; Rafinesque, C. 1819.2, 1820.1.

Oregon: *Littoral fauna*. Bretherton, B. J. 1900.1; Gilbert, C. H. 1890.3, 1895.1, 1897.1. — *List*. Jordan & Gilbert. 1880.30. — *Fresh-water fauna*. Baird, S. F., & Girard, C. 1861.1; Bean, T. H. 1883.7; Bendire, C. E. 1878.1; Eigenmann & Eigenmann. 1893.1; Girard, C. F. 1857.3, 6; Jordan, D. S. 1878.6 (*Clackamas R.*); Jordan & Snyder. 1909.1, 1913.1; Smith, C. J. 1879.1, 1880.1; Snyder, J. O. 1908.5; Suckley, G. 1860.1; Thornton, J. Q. 1849.1. — *Lake fauna*. Cope, E. D. 1883.6; Snyder, J. O. 1908.7. — *Crater Lake*. Evermann, B. W. 1897.8, 1898.1, 2. — *Klamath Lake*. Cope, E. D. 1879.3, 1883.6; Evermann, B. W. 1896.5. — *Silver Lake*. Cope, E. D. 1883.6, 1889.3.

Pennsylvania: Abbott, C. C. 1861.6; Baird, S. F. 1873.38; Bean, T. H. 1893.2; Blakeslee, M. A. 1874.1; Cope, E. D. 1862.1, 1864.1, 1865.1, 1869.2, 4, Add. 1883.1; Evermann, B. W., & Bollman, C. H. 1886.1 (*Monongahela R.*); ★Fowler, H. W. 1905.1, 1906.5, 6, 1907.5, 1908.3, 1910.4, 5, 1912.3, 1914.4, *Checklist*. Add. 1913.1; Norris, T. 1862.2 (*Schuylkill R.*); Stauffer, J. 1869.1. — *Susquehanna R.* Cope, E. D. 1879.4; Fowler, H. W. 1906.6; Haldeman, S. S. 1839.1,

Fauna — *Cont'd.*

1844.1; Stauffer, J. 1869.1; Thomas, G. Pre-Linn. 1698.1.

Rhode Island: *Lists.* Kendall, W. C. 1908.1; ★Tracy, H. C. 1906.2, 1910.1. — *Marine fauna.* Cope, E. D. 1870.3; Eigenmann, C. H. 1902.3; Gill, T. N. 1862.8, 1863.13; Mitchill, S. L. 1826.1; Tracy, H. C. Add. 1907.1–1909.1.

South Carolina: *General treatises, lists, etc.* Catesby, M. 1771.1, 1777.1; Gibbes, L. R. 1848.1; Gill, T. N. 1864.11; Holbrook, J. E. 1847.1, 1855.2, 1860.1; True, F. W. 1883.1. — *Fresh-water fauna.* Jordan, D. S., & Brayton, A. W. 1878.1. — *Pocotaligo R.* Stone, W. 1914.1. — *Marine fauna, chiefly of Charleston.* Bean, B. A., & Weed, A. C. 1909.1; Bean, T. H. 1878.2, 1880.2; Cope, E. D. 1870.7; Elliott, W. 1846.1; Holmes, F. S. 1856.1; Jordan, D. S., & Eigenmann, C. H. 1888.1; Jordan & Gilbert, C. H. 1883.19; Ravenel, E. 1850.1; Rea, P. M. 1909.1.

South Dakota: *Black Hills Region.* Evermann, B. W. 1892.1.

Tennessee: Boepple, J. F. 1912.1; Climax. 1880.2, 3; Cope, E. D. 1871.10, 17; Gilbert, C. H. 1888.1; Hay, O. P. 1883.1; Henshall, J. A. 1889.2; Jordan, D. S. 1890.4; Jordan & Brayton. 1878.1; Kirsch, P. H. 1893.1; Nicholson, H. 1880.1; Ragsdale, G. H. 1876.1.

Texas: *Fresh-water fauna.* Baird, S. F., & Girard, C. 1855.2; Bean, B. A. 1889.7; Daniel, J. W. 1878.1; Evermann, B. W. 1893.2, 1899.4; Evermann & Kendall, W. C. 1894.1; Fowler, H. W. 1904.7; Girard, C. F. 1858.1, 2, 1859.1, 3, 4; Jordan, D. S. 1878.7; Jordan & Gilbert, C. H. 1887.1; Pope, B. F. 1877.1; Taylor, N. A. 1878.1, 2. — *Marine fauna.* Caton, J. D. 1879.1; Evermann & Kendall. 1896.2; Johnson, S. M. 1879.2; Jordan & Gilbert, 1883.20. — *Zoological position of Texas.* Cope, E. D. 1880.2.

Utah: *Colorado Basin, Utah Lake, etc.* Cope, E. D. 1874.9, 1876.3, 1883.6; Cope & Yarrow. 1875.1; Gill, T. N. 1862.5, 1876.4; Jordan, D. S. 1891.5; Jordan & Gilbert, 1880.32; Jouy, P. L. 1882.1; Rockwood, A. P. 1874.1; Yarrow, H. C., & others. 1875.1.

Vermont: Ayres, W. O. 1849.1; Evermann, B. W., & Kendall, W. C. 1896.1 (*List*); Storer, D. H. 1844.16; Thompson, Z. 1842.1, 1848.1; Weeks, J. M. 1860.1; Williams, S. 1794.1.

Virginia: *Fresh-water fauna.* Burnaby, A. 1798.1; Cope, E. D. 1868.1, 1870.4; Evermann, B. W., & Kendall, W. C. 1898.1; Fowler, H. W. 1912.3; Healy, R. 1883.1; Jordan, D. S. 1880.1, 1889.1, 1890.4; Lewis, W. 1875.1. — *Marine fauna.* Bean, B. A. 1891.2; Fowler, H. W. 1914.9. — *Early reference.* Glover, T. Pre-Linn. 1676.1.

Washington: *Fresh-water fauna.* Bean, B. A. 1895.2; Bendire, C. E. 1882.1;

Evermann, B. W. 1899.1 (*Lake Chelan*); Evermann & Latimer, H. B. 1910.2; Evermann & Nichols, J. T. 1909.1; Gilbert, C. H., & Evermann. 1895.1 (*Columbia R.*); Girard, C. F. 1857.6; Jordan, D. S., & Seale, A. 1896.1 (*Crescent Lake*); Meek, S. E. 1899.2; Seale, A. 1895.1; Smith, R. 1883.1; Suckley, G. 1860.1; Swan, J. G. 1857.1. — *Marine fauna, chiefly of Puget Sound.* Bean, B. A. 1898.2; Bean, T. H. 1883.7, 9, 1887.4; Dean, B., Harrington, N. & others. 1896.1; Gilbert, C. H. 1889.1, 1890.3, 1895.1, 1897.1, 1904.1; Gilbert & Thompson, J. C. 1905.1; Girard, C. F. 1856.2, 1858.2, 1859.1; Hammond, J. P. 1887.1; Jordan, D. S., & Gilbert, C. H. 1880.15–1880.27, 1882.12, 1883.5, 1894.2; ★Jordan & Starks 1895.1 (*Gen. treat.*); Kendall, W. C. 1914.4; Starks, E. C. 1896.2. — *San Juan Is.* Starks, E. C. 1911.7.

West Virginia: Goldsborough, E. L., & Clark, H. W. 1908.1.

Wisconsin: Lapham, I. A. 1846.1; Marsh, C. D. 1906.1; Marshall, W., & Gilbert, N. C. 1905.1; Milner, J. W. 1874.1; Pearse, A. S. 1915.1; Putnam, F. W. 1866.1. — *Green Lake.* Wagner, G. 1910.1, 1911.1. — *Catalogue.* Anon. 261.

Wyoming: Cope, E. D. 1865.2, 1871.18; Curtis, J. E. 1884.1; Evermann, B. W. 1892.2, 1893.1. — *Yellowstone Park.* Bean, T. H. 1891.26; Dinsmore, A. H. 1906.1; Jordan, D. S. 1890.2, 1891.4.

WEST INDIES**General**

Bibliography. Cundall, F. 1909.1. — *List.* Jordan, D. S. 1887.8. — *Accounts of early voyagers to the West Indies: references in Pre-Linn. section.* Du Tertre, J. 1654.1; Gautier, d'A., J. 1752.1; Labat, J. 1722.1; Laet, J. 1625.1; Martyr, P. 1504.1; Oviedo, G. F. 1525.1; ★Sloane, H. 1707.1; *Early natural histories.* Rochefort, C. 1658.1; Smith, W. 1745.1.

Antigua: Martin, M. 1834.1; Riddell, M. 1792.1. — *See also* Leeward Is.

Bahama Is.: Andrews, E. A. 1893.1; Catesby, M. 1771.1, 1777.1, Pre-Linn. 1731.1; Cope, E. D. 1869.2; Eigenmann, C. H. 1916.1; Garman, S. 1896.2; Jordan, D. S., & Bollman, C. H. 1889.1; Plate, L. H. 1908.1; Putnam, F. W. 1861.5; Rosén, N. 1911.1; Bean, B. A. Add. 1905.1. — *For a list, see* Rept. U. S. Fish. Comm. 1886 (1889), vol. 14, pp. 669–672.

Barbados: Bean, B. A. 1903.2; Blosser, C. 1909.1; Filippi, F. 1861.1; Fischer, J. G. 1885.1; Gill, T. N. 1860.1, 5; Müller, J., & Troschel, F. 1848.1; Nichols, J. T. 1912.5; Regan, C. T. 1904.2; Schomburgk, R. H. 1848.1, 2. — *Early nat. histories in Pre-Linn. section.* Hughes, G. 1750.1; Ligon, R. 1657.1.

Bermudas: *Catalogues, lists, etc.* Bean, T. H. 1906.1; Goode, G. B. 1876.2, 1877.2, 3; Jones, J. M. 1876.1; Verrill,

A. E. 1902.1, 1903.2. — *Marine fauna*. Barbour, T. 1904.1; Bean, T. H. 1898.2, 1906.1, 2, 1912.1; Bristol, C. L., & Carpenter, F. W. 1900.1; Garman, S. 1900.1; Goode, G. B. 1874.1, 1877.2, 1879.12; Goode & Bean, T. H. 1878.9; Günther, A. 1879.1, 5; Jones, J. M. 1860.2, 3, 1874.1; Jones, Wedderburn, & Hurdis, 1859.1; Mark, E. L. 1904.1; Newman, E. 1860.2; Nilsson, S. 1860.3, 5; Townsend, C. H. & Barbour, T. 1906.1; Verrill, A. E. 1903.1; Hurdis, J. L. Add. 1897.1. — *Periodical literature relating to Bermudas*. Cole, G. W. 1907.1.

Cuba: *General treatises, lists, etc.* Gill, T. N. 1863.21; Guichenot, A. 1843.1, 1853.1; ★Poey, F. 1851.1, 1865.1, 1868.1, 1875.1, 1880.1; Saco, J. A. — *Remarks on Poey*. Baird, S. F. 1871.14, 1876.17. — *Fresh-water fauna*. Brown, B. 1913.1; ★Eigenmann, C. H. 1902.1, 2, 1903.3, 1912.1; McIndoo, N. E. 1907.1; Nichols, J. T. 1912.3. — *Marine fauna, chiefly*. Bean, T. H. 1885.3; Brevoort, J. C. 1864.1; Descourtilz, M. E. 1809.1; Desmarest, A. G. 1823.1; Garcia Canizares, F. 1911.1; Gilbert, C. H. 1906.1; Jordan, D. S. 1887.3; Jordan & Swain, J. 1885.2; McIndoo, N. E. 1907.1; Nichols, J. T. 1912.3; Parra, D. A. 1787.1; Poey, F. 1851.1–1883.1; Presas, M. 1896.1; Regan, C. T. 1905.2; Swain, J., & Meek, S. E. 1885.1; Torre y Huerta, C. 1910.1; Vilaró, J. 1885.1, 1890.1. — *Native names*. Bachiller y M. A. Add. 1883.1.

Curaçao: Lidth de Jeude, T. W. 1887.1; Meek, S. E. 1909.1; Simons, G. J. 1868.1.

Dominica: Atwood, T. 1791.1, 1795.1; Boulenger, G. A. 1891.3.

Guadeloupe: Vauchelet, — 1863.1.

Haiti; including Santo Domingo. — *Fresh-water fauna*. Evermann, B. W., & Clark, H. W. 1906.1; Hilgendorf, F. M. 1889.2; Nichols, J. T. 1915.6. — *Littoral fauna, chiefly*. Fowler, H. W. 1906.1, 1910.3, 1915.1; Gregg, A. 1806.1; Lönnberg, A. J. 1895.3; *Saona I.* Nichols, J. T. 1914.2. — *Works of travel*. Descourtilz, M. E. 1809.1; Santa Cruz, A. Add. 1908.1.

Jamaica: *Chiefly marine fauna.* — *Catalogues, lists, etc.* Cockerell, T. D. 1892.1; Gosse, P. H. 1851.2; Hill, R. 1881.1; *Remarks on Hill*. Agassiz, J. L. 1858.3. — *Various papers*. Bancroft, E. N. 1829.1–1835.2; Bean, T. H., & Dresel, H. G. 1885.1; Bennett, E. T. 1829.1; Boulenger, G. A. 1897.2; Browne, P. 1789.1; Fowler, H. W. 1900.2; Hill, R. 1851.2–1881.1, Add. 1855.1; Jordan, D. S., & Rutter, C. 1898.1; Lamont, A. 1824.1; Lewis, M. G. 1834.1; Martin, M. 1834.1; Werner, Franz. 1904.1; Wilson, C. B. 1911.1. — *Bibliography*. Cundall, F. 1895.1. — *Early nat. hist.* Browne, P. Pre-Linn. 1756.1.

Leeward Is., including St. Bartholomew, St. Christopher (St. Kitts), St. Eustatius, and St. Martin. Blumhof, J. 1798.1; Cope,

E. D. 1871.1; Euphrasen, B. A. 1795.1, 1798.1. — *See also* Antigua.

Martinique: Chanvalon, J. 1763.1; Pellegrin, J. 1912.14; Perugia, A. 1896.3; Sauvage, H. E. 1882.4.

Porto Rico: *Chiefly marine.* Bello y Espinosa, D. 1871.1; Evermann, B. W. 1902.9, 25; ★Evermann & Marsh, M. C. 1899.1, 1902.1, 2; Gill, T. N., & Smith, H. M. 1900.1, 2; Ledru, A. P. 1810.1, 1811.1, 1863.1; Nichols, J. T. 1915.2; Poey, F. 1881.1; Silvester, C. F. 1915.1; Stahl, A. 1883.1.

St. Lucia: *Port Castries, Catalogue.* Jordan, D. S. 1890.1.

St. Vincent: Boulenger, G. A. 1891.3.

Swan Is.: Regan, C. T. 1908.4.

Trinidad: *Fresh-water fauna.* Boulenger, G. A. 1890.2; ★Gill, T. N. (*Synopsis*) 1853.5; Günther, A. 1869.8; ★Regan, C. T. 1906.9. — *Marine fauna, chiefly*. Bean, B. A. 1895.1, 3; Bennett, E. T. 1830.2; Gill, T. N. 1860.4; Ledru, A. P. 1810.1, 1811.1; Léotaud, A. 1858.1 (*List*); Martin, M. 1834.1; Vincent, H. Add. 1910.1.

Virgin Is.; *St. Croix (Santa Cruz), and St. Thomas.* Cope, E. D. 1871.1; Ledru, A. P. 1810.1, 1811.1.

CENTRAL OR MIDDLE AMERICA

General

General treatises. ★Günther, A. C. 1869.1; ★Regan, C. T. 1906.10, 1915.3; Vaillant, L., & Bocourt, F. 1874.1. — *See also above under North America.* — *Catalogues of fresh-water fishes.* Eigenmann, C. H. 1893.1, 1910.1. — *Popular acc't, fresh-water fauna.* Eigenmann, C. H. 1906.1. — *List of deep-sea Pacific forms.* Garman, S. 1899.1. — *List of Pacific coast fishes.* Jordan, D. S. 1886.2.

British Honduras: *Fresh-water fauna.* Bocourt, F. 1868.3; Kner, R. 1860.1; Meek, S. E. 1907.1; Regan, C. T. 1904.3.

Clipperton I., and Cocos I.: Snodgrass, R. E., & Heller, E. 1905.1, 1906.1. — *Clipperton I., only.* Garman, S. 1899.2.

Costa Rica: *Fresh-water fauna.* Meek, S. E. 1907.1, 1909.1–1912.1, (*List*) 1914.1; Regan, C. T. 1907.4, 1908.2. — *Littoral fauna of Punta Arenas, Pacific O.* Gilbert, C. H. 1883.1; Jordan, D. S. 1886.2; Jordan & Gilbert. 1888.1.

Guatemala: *Fresh-water fauna.* Bocourt, F. 1868.3; Meek, S. E. 1906.1, 1907.1; Miller, N. 1907.1 (*Motagua R.*); Regan, C. T. 1907.4; Steindachner, F. 1864.1; *Lakes Amatitlan and Atitlan.* Meek, S. E. 1908.1. — *Marine fauna of both coasts.* Günther, A. 1864.12, 1866.4, 1869.1. *Of Atlantic Coast.* Bleeker, P. 1863.22. *Of Pacific Coast.* Bocourt, F. M. 1868.1; Jordan, D. S. 1886.2.

Mexico: *General treatises on fresh-water fishes.* ★Meek, S. E. 1902.2, 1904.1; *Review of Meek.* 1904.1. Evermann, B. W. 1905.3. — *Distribution of fresh-water fishes.*

Fauna — *Cont'd.*

Meek, S. E. 1903.1,2. — *Miscellanea, works of travel, etc.* Clavigero, F. X. 1780.1, 1787.1, 1882.1; Menonville, N. J. 1810.1; Müller, J. W. 1864.1; Hernandez, F. Pre-Linn. 1651.1. **Atlantic Slope:** *Fresh-water fauna.* — *Streams of Chihuahua: Rio Conchos, and other affluents of Rio Grande.* Baird, S. F. & Girard, C. F. 1855.2; Bean, T. H. 1898.1; Evermann, B. W., & Goldsborough, E. L. 1902.3; Gilbert, C. H. 1891.2; Girard, C. F. 1858.1, 1859.3; Meek, S. E. 1907.1; Woolman, A. J. 1892.1, 1895.1; Cope, E. D. Add. 1886.3. — *Rio Soto la Marina. (Tamaulipas)* Fowler, H. W. 1903.5; Meek, S. E. 1904.1. — *Rio Panuco Basin.* Bean, T. H. 1892.10; Jordan, D. S., & Snyder, J. O. 1901.5; Meek, S. E. 1904.1, 1907.1; Regan, C. T. 1908.4. — *Orizaba: Rio Blanco.* Cope, E. D. 1869.2; Heckel, J. J. 1848.1; Regan, C. T. 1905.1; Woolman, A. J. 1895.1. — *Coastal streams of Vera Cruz and Isthmus of Tehuantepec.* Boulenger, G. A. 1909.3; Cope, E. D. 1871.6, 1872.1; Evermann & Goldsborough. 1902.3; Günther, A. 1860.5; Regan, C. T. 1904.3, 1914.3; Vaillant & Pellegrin. 1902.1. — *Fresh-water fauna of Yucatan.* Barbour, T. & Cole, L. J. 1906.1; Cole, L. J. 1907.1; Evermann & Goldsborough. 1902.1,3; Regan, C. T. 1907.4, 1914.2,3. **Pacific Slope:** *Fresh-water fauna.* — *Sonora: coastal streams, especially Rio Yaqui system.* Baird, S. F. & Girard, C. F. 1855.2; Bean, T. H. 1898.1; Girard, C. F. 1858.1, 1859.2,3; Meek, S. E. 1902.2; Rutter, C. M. 1896.1; Snyder, J. O. (inc. *Altar R.*) 1915.1. — *Lower Cal., San Ignacio.* Evermann, B. W. 1908.1. — *Sinaloa, Rosario.* Evermann, B. W. 1898.6; *Rio Presidio at Mazatlan.* Jordan, D. S. 1889.4, 1895.3. — *Tres Marias Is.* Evermann, B. W. 1898.6. **Rio Lerma:** *Basin comprising Guanajuato, Valley of Mexico, Lakes Chapala, Cuitzeo, and Patzcuaro and Rio Verde.* Bean, T. H. 1879.5, 1887.7, 1892.10; Boulenger, G. A. 1900.7; Evermann, B. W., & Goldsborough, E. 1902.3; Jordan, D. S. 1880.3, 1900.4; Jordan & Snyder. 1901.5; Meek, S. E. 1902.2, 1907.1; Pellegrin, J. 1901.4; Seurat, L. G. 1898.1; Therese von Bayern. 1894.1; T. von B., & Steindachner, F. 1895.1; Woolman, A. J. 1895.1; Bean, B. A. Add. 1899.1. — *I. of Tehuantepec, streams.* Günther, A. 1860.5; Meek, S. E. 1905.1. **Marine fauna:** *Atlantic marine fauna.* Abbott, C. C. 1861.1; Bean, T. H. 1890.21; Evermann & Goldsborough 1902.3; Jordan & Dickerson 1908.2; Regan, C. T. 1908.4; Steindachner, F. 1863.9. — *Pacific marine fauna, chiefly of Gulf of California at Cape San Lucas and Mazatlan.* Baird, S. F. 1875.31; Bocourt, F. 1868.1,2; Diguët, L. 1898.1; Evermann, B. W. 1908.1; Evermann & Jenkins, O. P. 1888.1, 1891.1; Gilbert, C. H. 1890.3, 1892.2, 1897.1, 1904.1; Gill, T. N. 1864.1, 1866.3; ★Jordan, D. S. 1885.14, 1886.2, 1895.3, 1896.1; ★Jordan & Gilbert, 1882.2,5,8,9,11, 1883.1,3,6,8,9,12,13,

.17,24, 1884.2, 1885.1; Jordan & Starks, E. C. 1896.1; Kendall, W. C., & Radcliffe, L. 1912.1; Lockington, W. N. 1880.4, 1882.1; Osburn, R. C., & Nichols, J. T. 1916.1; Pellegrin, J. 1901.5, 1908.19; Rutter, C. M. 1904.2; Smith, R. 1883.3, 1885.1, 1886.1; Steindachner, F. 1870.3, 1877.1; Streets, T. H. 1878.1; Vaillant, L. L. 1894.4; ★Vaillant & Bocourt, F. 1874.1.

Nicaragua: *Fresh-water fauna, chiefly of Lake Nicaragua.* Agassiz, J. L. 1858.6; Gill, T. N., & Bransford, J. F. 1877.1; Jordan, D. S. 1889.3; Meek, S. E. (*Synopsis.*) 1907.1,2, Add. 1913.1; Smith, H. M. 1893.5. — *Marine fauna of Atlantic Coast.* Fowler, H. W. 1903.7.

Panama: *Fresh-water fauna.* Boulenger, G. A. 1899.15; Eigenmann, C. H. 1905.2; Evermann, B. W., & Goldsborough, E. L. 1909.1, 1910.1; Garman, S. 1906.2; Gill, T. N. 1876.3; Günther, A. 1861.5, 1866.4, 1869.1; Kner, R., & Steindachner, F. 1870.1; Maack, G. A. 1879.1; ★Meek, S. & Hildebrand, S. 1912.1, 1913.1, 1916.1; Steindachner, F. 1876.3, 1877.1, 1879.1; Vaillant, L. 1897.1; Wagner, M. F. 1865.1, 1870.1,2. — *Atlantic marine fauna.* Boulenger, G. A. 1899.15; Haly, A. 1875.1; Swan, J. O. 1880.2. — *Pacific marine fauna.* Baer, G. A. 1899.1; Garman, S. 1877.1, 1891.1; Gilbert, C. H. 1891.4, 1892.1; ★Gilbert & Starks, E. C. 1904.1; Gill, T. N. 1864.10; Günther, A. 1861.5, 1864.10, 1866.4, 1869.1; Jordan, D. S. 1886.2; Jordan & Gilbert. 1882.7, 1883.8,10,14,15,16,18,24, 1885.1, 1888.1; Kendall, W. C., & Radcliffe, L. 1912.1; Kner, R., & Steindachner, F. 1870.1; Morris, J. C. 1857.1; Steindachner, F. 1875.2, 1876.3, 1877.1.

Revilla Gigedo Is.: Gilbert, C. H. 1890.3, 1897.1; Jordan, D. S., & McGregor, R. C. 1899.1; Snodgrass, R. E., & Heller, E. 1905.1, 1906.1.

Salvador: *Marine fauna.* Bocourt, F. 1868.1,2, 1869.1; Jordan, D. S. 1886.2.

SOUTH AMERICA**General**

Fresh-water fauna: *Catalogue and bibliography.* ★Eigenmann, C. H. 1910.1. — *Catalogue.* Eigenmann & Eigenmann. 1892.2. — *Popular accounts.* Eigenmann, C. H. 1906.1, 1913.1, 1914.1. — *Origin of fauna.* Eigenmann. 1912.3. — *Distribution, Archiplata-Archhelenis theory.* ★Eigenmann. 1909.3. — *Distribution.* Hasegawa, J. D. 1912.2; Pfeffer, G. J. 1905.1. — *Works of travelers relating to the South American fauna.* Castelnau, F. L. 1955.1; Humboldt & Bonpland. 1805.1-1852.1; Orbigny, A. D. 1835.1; Orton, James. 1870.1; Poeppig, E. F. 1835.1; Therese von Bayern, 1900.1; Ulloa, J. J., & Ulloa, A. 1772.1. See also the works of travel cited under Brazil.

Argentina: *Works of travel.* Holmberg, E. L. 1884.1; Schmidel, U. 1903.1. — *Marine fauna.* ★Berg, C. 1893.1-

1898.2, *List* 1895.1; Burmeister, H. 1868.1; Evermann, B. W., & Kendall, W. C. 1906.1; Lahille, F. 1913.2; Perugia, A. 1891.1. **Fresh-water fauna:** of *La Plata R. and vicinity of Buenos Aires*. Clark, R. S. 1912.1; Eigenmann, C. H. 1907.2, 4; Engmann, P. 1912.1; Günther, A. 1880.1; Lahille, F. 1895.1, 1908.2; Mitre, B. 1903.1; Perugia, A. 1891.1; Regan, C. T. 1905.2, 1909.6; Steindachner, F. 1867.6 (iii), 1908.6. — *Fresh-water fauna of various localities*. Berg, C. 1895.2, 1897.1; Boulenger, G. A. 1895.11, 1897.13, 1898.7, 1902.23; Ellis, M. L. 1911.1, 1913.1; Evermann & Kendall. 1906.1; Günther, A. 1883.2; Haseman, J. D. 1911.1, 2; Haseman & Eigenmann. 1911.1; Henn, A. W. 1916.1; Holmberg, E. L. 1891.1; Jenyns, L. 1842.1; Regan, C. T. 1906.3, 8, 1907.7, 1908.6, 1909.8; Weyenbergh, H. 1877.1. **Patagonia:** *Works of travel*. Falkner, T. 1774.1; Benignus, S. Add. 1912.1. — *Fresh-water fauna*. ★Eigenmann, C. H. 1909.3; Smitt, F. A. 1901.1. — *Marine fauna*. Cunningham, R. O. 1870.1, 1871.1; Günther, A. 1881.1; Hussakof, L. 1914.2; Jenyns, L. 1842.1; Jordan, D. S. 1888.3; Perugia, A. 1891.1. **Tierra del Fuego:** *Marine fauna, including Straits of Magellan*. Banks, Joseph 1896.1; Cunningham, R. O. 1870.1, 1871.1; Forster, J. H. 1844.1; Günther, A. 1881.1; Hussakof, L. 1914.2; Jenyns, L. 1842.1; Perugia, A. 1891.1; Smitt, F. A. 1897.1; Vaillant, L. L. 1888.3.

Bolivia: Boulenger, G. A. 1897.13; Eigenmann, C. H. 1915.1, 2; Ellis, M. L. 1911.1, 1913.1; Ellis, M. M. 1913.1; Gill, T. N. 1896.11; Haseman, J. D. 1911.1, 2; Haseman & Eigenmann 1911.1; Henn, A. W. 1916.1; Perugia, A. 1897.2; Girard, C. F. Add. 1889.1. — *Lake Poopó*. Neveu-Lemaire, M. 1906.2; Pellegrin, J. 1904.7, 1906.8.

Brazil: *General treatises*. ★Ribeiro, A. 1907.1, 2, 1909.1, 1911.1, 1915.1; ★Spix, J. B., & Agassiz, L. 1829.1. — *Bibliography*. Ihering, H. 1902.1, 1911.2. — *General natural histories*. Anchieta, J. 1799.1; Wappäus, J. E. 1871.1; Wied-Neuwied, M. A. 1825.1, 1850.1; Anon. 419; *Early natural histories in Pre-Linn. Section*. Laet, J. 1648.1; ★Marcgrave, G. 1643.1. — *Narratives of travel relating to the Amazonian and Brazilian fauna*. Agassiz, L., & Agassiz, E. C. 1868.1; Bates, H. W. 1863.1; Edwards, W. H. 1847.1; Hartt, C. F. 1867.1; Orton, J. 1870.1; Poeppig, E. F. 1835.1; Roosevelt, T. 1914.1; Smith, Herbert H. 1879.1; Spix, J. B., & Martius, C. F. 1823.1, 1824.1; Anon. 217, 229; Fletcher, J. C., & Kidder, D. P. Add. 1866.1; Keller, F. Add. 1874.1; Woodroffe, J. F. Add. 1914.1; *Early travels in Pre-Linn. Section*. Acuña, C. 1641.1; Herrera, — A. 1725.1; Magalhães de Gadvao, P. 1576.1; Stade, H. 1557.1. — *Earliest descriptions of Brazilian fishes*. Léry, J. Pre-Linn. 1578.1; *First figures of Brazilian fishes*. Thévet, F. A. 1558.1. **Marine fauna:** of various localities. Gil-

bert, C. H. 1900.1; Heckel, J. J. 1840.1; Meade-Waldo, E., & Nicoll, M. 1906.1; Regan, C. T. 1914.1, 4; Schultze, M. J. 1862.1; Starks, E. C. 1913.1; Steindachner, F. 1877.1; Ribeiro, A. Add. 1912.1. — *Fernando Noronha I.* Boulenger, G. A. 1890.6. — *Santa Catharina I.* Pernety, A. J. Add. 1770.1. **Fresh-water fauna:** of various localities. Commerson, P.; Eigenmann, C. H. 1894.3, 1908.1; Eigenmann & Bray, W. L. 1894.1; Eigenmann & Eigenmann 1888.4, 1889.3, 8, 1890.3; Eigenmann & Henn, A. 1914.1, 1916.1; Ekstrand, C. H. 1823.1; Ellis, M. L. 1911.1, 1913.1; Fowler, H. W. 1906.4; Garman, S. 1890.1–5; Günther, A. 1868.3, 4; Haseman, J. D. 1911.1, 1911.2; Haseman & Eigenmann. 1911.1; Henn, A. W. 1916.1; Hensel, R. F. 1868.1, 1870.1; Ihering, R. 1905.1, 1907.1, 3, 1911.1, 1914.1; Kindle, E. M. 1895.1; Kner, R. 1858.1, 2; Pellegrin, J. 1902.2, 1909.2; Perugia, A. 1891.1; Reinhardt, J. T. 1859.1; Ribeiro, A. 1902.1; Starks, E. C. 1913.1; Steindachner, F. 1874.3, 1903.2, 1907.2, 1908.1, 4; Ulrey, A. B. 1894.2, 1895.1; Valenciennes, A. 1847.2, 1850.1. **Amazon:** *River and Basin*. Agassiz, J. L. 1865.1, 1896.1; Ayres, W. O. 1851.1; Berg, C. 1901.1; Boulenger, G. A. 1897.6, 1898.4, 9 (*Rio Jurua*); Castelnau, F. L. 1855.1; Cope, E. D. 1871.2, 4, 11; Eigenmann, C. H., & Bean, B. A. 1907.1; Geibel, C. G. 1871.1; Gill, T. N. 1858.2, 1860.2; Goeldi, E. A. 1898.4, 1900.1, 1902.1, 1905.1; Günther, A. 1866.6, 1872.5, 1896.1; Hagmann, G. 1901.1, 1902.1; Harting, P. 1866.4; Marcoy, P. 1869.1; Orton, E. 1873.1; Regan, C. T. 1909.8, 1911.10, 1912.7; Snethlage, E. 1909.1; ★Steindachner, F. 1875.1, 1876.1, 3, 1877.1, 1882.3, 1908.2, 10, 1909.6, 1911.7; Vaillant, L. L. 1880.2, 3. — *Ambi-yacu R.* Cope, E. D. 1871.13, Add. 1871.1; Anon. 215, 237. — *Marajo I.* Boulenger, G. A. 1897.8; Goeldi, E. A. 1896.1, 1898.1, 2, 3, 1900.2. — *Rio Negro and Manáos*. Boulenger, G. A. 1895.6; Capello, F. 1870.5; Nichols, J. T. 1915.3; Pellegrin, J. 1899.4; Regan, C. T. 1905.9, 1909.8; Steindachner, F. 1882.3; Wallace, A. R. (n.d.). — *Madeira R.* Fowler, H. W. Add. 1914.4. — *For Peruvian Amazon, see under Peru*. **Bahia:** *Marine fauna*. Castelnau, F. L. 1855.1; Haly, A. 1875.1; Jordan, D. S. 1891.1; Steindachner, F. 1863.10. — *Fresh-water fauna*. Steindachner, F. 1874.3. **Ceará:** (State) Steindachner, F. 1911.7. **Matto Grosso:** Boulenger, G. A. 1889.1, 1892.5, 1895.1, 1895.8, 1900.19, 1902.10; Regan, C. T. 1903.4; *Rio Xingu*. Steindachner, F. 1907.3. **Minas Geraes:** *Rio das Velhas*. Lütken, C. F. 1874.4, 1875.1, 1880.5; Reinhardt, J. T. 1880.1; Steindachner, F., *R. Mucury*. 1867.5, *R. Arassuahy*. 1874.3, *R. Preto*. 1907.5. **Paraná:** *Rio Iguasú*. Haseman, J. D. 1911.3; *Parranagua*. Regan, C. T. 1913.7. **Piauí:** *R. Parnahyba*. Steindachner, F. 1906.3, 1907.5, 1908.7, 1909.5. **Rio De Janeiro:** *Fresh-water fauna (chiefly)*. Boulenger, G.

Fauna — *Cont'd.*

A. 1896.1; Jenyns, L. 1842.1; Peters, W. C. 1868.4; Regan, C. T. 1913.6; Schreiner, C., & Ribeiro, A. 1903.1; Steindachner, F. 1874.3. — *Marine fauna*. Castelnau, F. L. 1855.1; Kner, R. 1864.4, 1865.3; Regan, C. T. 1903.3, 7. **Rio Grande Do Sul:** *Fresh-water fauna*. Boulenger, G. A. 1887.3, 1889.1, 1891.1; Cope, E. D. 1894.3, 4, 5; Eigenmann, C. H. 1894.3, 1907.4; Hensel, R. F. 1868.1, 1870.1; Ihering, H. 1893.2, 1898.2. — *Marine fauna*. Ihering, H. 1893.1, 1897.1, 1898.2. **Rio San Francisco:** Steindachner, F. 1907.5, 1908.9, 1910.2. **Santa Catharina:** *Rios Cubataõ, Iguasú and Itapocú*. Haseman, J. D. 1911.3; Steindachner, F. 1874.3, 1907.6, 1908.3, 1911.2. **São Paulo:** *Fresh-water fauna*. Boulenger, G. A. 1900.6; Eigenmann, C. & Norris, A. 1900.1; Meek, S. E. 1905.2; Regan, C. T. 1907.3 (*Rio Piracicaba*); Ribeiro, A. *Itatiaya* 1906.1, 1908.1, *R. Iporanga* 1907.3, 1908.1; Steindachner, F. *Jaragua* 1910.2. — *Marine fauna*. Ihering, H. 1898.1; Steindachner, F. 1870.3, 1875.2, 1908.7.

Chile: *General treatises, lists, etc.* ★Delfin, F. T. 1898.1, 1899.2, 1903.1; Guichenot, A. 1848.2; Molina, G. I. 1776.1–1810.1; Porter, C. E. 1909.1, 2, 3; Quijada, B. B. 1912.1, 1913.1; Reed, E. C. 1897.1. — *Distribution*. Guichenot, A. 1847.1, 1850.1. — *Work of travel*. Poepig, E. F. 1835.1. — *Bibliography*. Porter, C. E. 1898.2, 1904.1. **Marine fauna:** Abbott, C. C. 1861.4; Abbott, J. F. 1900.1; Castillo, L. 1912.2; Delfin, F. T. 1899.2–1903.3; Gilbert, C. H. 1911.1; Grube, A. E. 1879.1; Jenyns, L. 1842.1; Kner, R. 1864.4, 1865.3; Lahille, F. 1913.3; Pellegrin, J. 1904.6; Perez, C. C. 1886.1; Perez Canto, C. 1912.1; Philippi, R. A. 1857.1–1902.1; Pinochet, A. C. 1902.1 (*La Mocha I.*); Porter, C. E. 1898.1–1909.5; Steindachner, F. 1896.3; Steuber, N. J. 1905.1. **Fresh-water fauna:** Girard, C. F. 1855.1, 1856.1; Philippi, R. A. 1866.1, 1867.1; Regan, C. T. 1908.5; Steindachner, F. 1898.1, 1913.1.

Colombia: *Fresh-water fauna*. — *Local faunistic works*. Velasco, J. 1844.1; Posada-Arango, A. Add. 1909.1. — *Highland fauna of Andes*. Boulenger, G. A. 1887.5; Eigenmann, C. H. 1914.2, 3; Humboldt, F. H. 1805.1; Regan, C. T. 1903.4; Girard, C. F. Add. 1889.1. — *Rio Meta of Orinoco System*. Eigenmann, C. H. 1914.2, 3. — *Rio Cheneche*. Thominot, A. 1884.1. — *San Juan R. of Pacific Slope*. Boulenger, G. A. 1911.9; Regan, C. T. 1907.3, 1913.11, 1914.5. — *Magdalena Basin, including Cauca R.* Boulenger, G. A. 1895.3; ★Steindachner, F. 1879.5, 1880.1, 3, 1900.1, 1902.2. — *Magdalena and Cauca; San Juan; Patia; and Atrato systems*. Eigenmann, C. H. 1912.4, 1913.3, 1916.2; Eigenmann & Fisher. 1914.1; Eigenmann & Henn. 1914.1, 1916.1; Eigenmann, Henn, & Wilson. 1914.1; Henn, A. W. 1916.1. — *Marine fauna of Pacific*

Coast. Jordan, D. S., & Bollman, C. H. 1890.1; Kner, R., & Steindachner, F. 1870.1. — *Of Caribbean Coast*. Steindachner, F. 1900.1, 1902.2.

Ecuador: *Fresh-water fauna of Pacific slope*. — *Streams about Guayaquil; Rios Daule, Vinces, Guayas, etc.* Eigenmann, C. H. 1914.3, 1916.2; Eigenmann & Fisher. 1914.1; Eigenmann & Henn. 1914.1, 1916.1; Eigenmann, Henn & Wilson. 1914.1; Fowler, H. W. 1911.5; Garman, S. 1877.1; Günther, A. 1859.2, 5, 1860.7; Henn, A. W. 1916.1; Kner, R., & Steindachner, F. 1870.1; Pellegrin, J. 1909.6, 1912.6; Starks, E. C. 1906.1; ★Steindachner, F. 1880.3, 1900.1, 1902.2; Thominot, A. 1882.1; Wagner, M. F. 1865.1, 1870.1, 2. — *Mindo, Rio Esmeraldas headwaters*. Eigenmann & Henn 1914.1; Regan, C. T. 1916.4. — *North-western Ecuador; La Tola, Sapayo, etc.* Regan, C. T. 1903.4. — *Andean highland fauna (Arges or Cyclopium)*. Boulenger, G. A. 1890.4, 1899.2; Boussingault, J. B. 1864.1; Evermann, B. W., & Kendall, W. C. 1905.1; Girard, C. F. 1889.1, Add. 1889.1; Humboldt & Bonpland. 1805.1; Orton, J. 1870.1, 1871.1; Wagner, M. F. 1865.1, 1870.1, 2. — *Fauna of Amazon Basin; Napo R., Canelos, Pebas, etc.* Boulenger, G. A. 1887.1, 1898.18; Cope, E. D. 1871.2, 1878.7; Gill, T. N. 1871.1; Orton, J. 1870.1; Pellegrin, J. 1909.6, 1912.6; Steindachner, F. 1879.1. — *Marine fauna*. Starks, E. C. 1906.1; Steindachner, F. 1900.1, 1902.2.

Falkland Is.: Boulenger, G. A. 1900.12; Jenyns, L. 1842.1; Pernety, A. J. 1771.1.

Galapagos Is.: Garman, S. 1899.1; Gilbert, C. H. 1891.4, 1892.1; Günther, A. 1877.2; Jenyns, L. 1842.1; Jordan, D. S. 1888.3; Jordan & Bollman, C. H. 1890.1, Add. 1890.1; Jordan & Gilbert 1884.1; Kendall, W. C., & Radcliffe, L. 1912.1; Snodgrass, R. E., & Heller, E. 1903.1, 1905.1, 1906.1; Steindachner, F. 1879.2, 1882.2; Jordan & Fesler, B. Add. 1889.1.

Guiana, British: *General treatises*. ★Eigenmann, C. H. 1912.2; Schomburgk, R. H. 1841.1; Hargreaves, T. S. Add. 1904.1. — *Fresh-water fauna*. Boulenger, G. A. 1897.4; Durbin, M. L. 1909.1; Eigenmann, C. H. 1909.4; Günther, A. 1863.1, 1872.8; Hancock, J. 1828.2; Müller, J., & Troschel, F. H. 1848.1; Quelch, J. J. 1894.1, 1897.1; Regan, C. T. 1906.8, 1908.3; Steindachner, F. 1882.3; Traill, T. S. 1832.2; Fowler, H. W. Add. 1914.5. — *Marine fauna*. Aiken, J. 1913.1; Appun, K. F. 1870.1; Bancroft, E. 1769.1, 2; Blosser, C. 1909.1; Dalton, H. G. 1855.1; Martin, M. 1834.1.

Guiana, Dutch: *Fresh-water fauna*. Bryant, W. 1786.1; Günther, A. 1868.3, 4; Kappler, A. 1885.1; Steindachner, F. 1867.4, 6, 1910.1. — *Marine fauna*. Bleeker, P. 1862.3, 5, 1863.27, 29, 1864.3, 1865.4, 5, 8, 1866.5, 1873.2, 1876.5; Cope, E. D. 1869.2; Fowler, H. W. 1906.1. —

Geographical treatises with inclusion of fishes. Fermin, P. 1765.1, 1769.1; Hartsinck, J. J. 1770.1; Stedman, J. G. 1796.1; Herlein, J. Pre-Linn. 1718.1.

Guiana, French: *Fresh-water fauna.* Pellegrin, J. 1902.1, 1908.10, 1909.9; Vaillant, L. L. 1898.1, 1899.1, 1900.1. — *General geographical works with incidental matter about fishes.* Bajon, — 1777.1; Bataille, V. 1863.1; Bellin, N. 1762.1; Jeffreys, T. 1760.1; Mongrolle, — 1802.1; Galard de Terraube, L. A. Add. 1799.1. — *Early natural histories.* Barrère, P. Pre-Linn. 1741.1; Richer, J. 1729.1.

Juan Fernandez Is.: Steindachner, F. 1875.2; Cooke, E. Pre-Linn. 1712.1.

Paraguay: Boulenger, G. A. 1895.1, 8, 1896.5, 1900.19, 1902.10; Dobrizhoffer, M. 1783.1; Ehlers, E. H. 1894.2; Eigenmann, C. H. 1907.3; Eigenmann & Kennedy. 1903.1; Eigenmann, McAtee & Ward. 1907.1; Ellis, M. L. 1911.1, 1913.1; Ellis, M. M. 1913.1; Günther, A. 1894.1; Haseman, J. D. 1911.1, 2; Haseman & Eigenmann. 1911.1; Kerr, J. G. 1897.1, 1898.1, 1899.1; Perugia, A. 1891.1, 1897.3. — *Catalogue.* Bertoni, A. Add. 1914.1.

Peru: *General treatises.* — "*Fauna Peruana.*" Tschudi, J. J. 1844.1. — *See also* Evermann & Radcliffe; Bull. 95, U. S. Nat. Mus., 1917. — *Fresh-water fauna; Streams of Pacific slope at Lima and Pacasmayo.* Ehrenberg, C. G. 1848.1; Starks, E. C. 1906.1; Steindachner, F. 1900.1, 1902.2. — *Highland fauna of Andes, chiefly Arges, Pygidium and Orestias.* Boulenger, G. A. 1890.4, 1902.4; Eigenmann, C. H. 1913.2; Evermann, B. W., & Radcliffe, L. 1909.1; Steindachner, F. 1876.3, 1879.1, 1882.3, 1907.4; Cope, E. D. Add. 1874.1; Girard, C. F. Add. 1889.1. — *Peruvian Amazon.* Cope, E. D. 1878.7; Günther, A. 1869.4; Gill, T. N. 1871.1; Regan, C. T. 1903.4. *Iquitos.* Steindachner, F. 1891.1. — *Nauta.* Cope, E. D. 1874.2, 1878.7. — *Huallaga R.* Steindachner, F. 1879.1. — *Ucayali R.* Boulenger, G. A. 1887.3; Castelnau, F. L. 1855.1; Marcoy, P. 1869.1; Regan, C. T. 1913.10. — *Urubamba R.* Cope, E. D. 1877.12, 1878.7. — *Marine fauna:* Abbott, J. F. 1899.1; Baer, G. A. 1899.1; Cope, E. D. 1877.12; Garman, S. 1877.1; Kendall, W. C., & Radcliffe, L. 1912.1; Porter, C. E. 1909.2, 4; Regan, C. T. 1913.9; Starks, E. C. 1906.1; Steindachner, F. 1875.2, 1900.1, 1902.2. — *Chinchas Is.* Steindachner, F. 1867.5.

Titicaca Lake: Cope, E. D. 1875.2, 1877.12; Garman, S. 1876.1; Neveu-Lemaire, M. 1906.1, 2; Pellegrin, J. 1904.7, 1906.8; Steindachner, F. 1902.2; Coker, R. E. Add. 1910.3, 1911.1. — *See also* Evermann & Radcliffe; Bull. 95, U. S. Nat. Mus., 1917.

Uruguay: *Fresh-water fauna.* Jenyns, L. 1842.1; Steindachner, F. 1870.5. — *Marine fauna.* Berg, C. 1895.1 (*List*); Perugia, A. 1891.1.

Venezuela: *For* Trinidad, *see above* under West Indies. — *Travel.* Garces, M.

1890.1. — *Fresh-water fauna.* Boulenger, G. A. 1903.1; Fowler, H. W. 1911.8; Peters, W. C. 1877.3; Regan, C. T. 1903.1, 4, 1905.5; Steindachner, F. 1882.3. — *Orinoco system.* Pellegrin, J. 1912.2; Steindachner, F. 1879.1, 1910.1; *Apure R.* Pellegrin, J. 1899.2; *Meta R.* Eigenmann, C. H. 1914.2; Roulin, F. D. 1829.1; Steindachner, F. 1910.3. — *For fishes of Lake Valencia, Caracas, and Rio Tuy, see* Eigenmann, C. H. in *Indiana Univ. Studies*, no. 4, vol. VII, 1920.

ASIA

General

Distribution, relations with Australia. Popta, C. M. 1912.3. — *General discussion of faunal affinities.* Sauvage, H. E. 1881.4. — *Comparison, faunas of north and south faces of the Himalayas.* Stewart, F. H. 1909.1.

Afghanistan: Day, F. 1880.10; Regan, C. T. 1906.13 (*Helmand Basin*); Günther, A. Add. 1888.1.

Arabia: *Fresh-water fish from Aden.* Playfair, R. I. 1870.1. — *Marine fauna of Gulf of Aden.* Brauer, A. 1902.1; Károli, J. 1882.1; Lloyd, R. E. 1907.1; Pellegrin, J. 1904.10, 1906.15; Picaglia, L. 1894.1; Steindachner, F. 1902.1, 4. — *Gulf of Oman.* Boulenger, G. A. 1887.2, 1889.3, 1892.8, 1895.4, 1897.10, 1900.4, 1901.2, 17; Regan, C. T. 1905.12. — *Gulf of Akabah.* Steindachner, F. 1898.2. — *See also* Red Sea under Africa.

Baluchistan: Zugmayer, E. 1912.1, *Synopsis.* 1913.3. — *Nushki.* Günther, A. Add. 1888.1.

Black Sea; *see under* Europe.

Caspian Sea; *see under* Europe, Russia.

Ceylon: *Chiefly fresh-water.* Blanford, W. T. 1901.1; Blyth, E. 1852.1, 1866.1; Boake, B. 1866.1; ★Day, F. 1875.1, 1889.1 (*General treatises*); Duncker, G. 1912.2; Günther, A. 1866.1; Henry, G. M. 1912.1; Huxley, T. H. 1861.1; Ke-laart, E. F. 1852.1; Pearson, J. 1912.1; Pertwee, A. H. 1913.1; Tennent, J. E. 1861.1. — *Constitution of fauna.* Willey, A. 1904.1. — *Marine fauna.* Alcock, A. W. 1899.3 (*Gulf of Manar*); Bennett, E. T. 1832.1; Bennett, J. W. 1828.1, 1834.1, 1851.1; Blanford, W. T. 1901.1; Bleeker, P. 1863.2, 6, 1864.2; Blyth, E. 1852.1; Brauer, A. 1902.1; Duncker, G. 1910.1; Haly, A. 1883.1; Johnstone, J. 1904.3; Károli, J. 1882.1; Pearson, J. 1911.2 (*Jaffna I.*); Southwell, T. 1910.1; Tattersall, W. M. 1903.2; Willey, A. 1908.3, 1909.2; Haly, A. Add. 1884.1–Add. 1890.1. — *Works of travel.* Doflein, F. J. 1906.2; Sonnerat, P. 1782.1, 1783.1.

China: — *General papers and marine fauna.* Bleeker, P. 1863.3, 19, 1865.1, 11, 14, 20, 1870.1, 2, 3, 4, 1871.2, 1872.1, 1873.1, 4, 5, 12, 14, 25, 27, 1877.13, 1878.6, 1879.6; Cantor, T. E. 1842.1 (*Chusan I.*) Courcy, — 1666.1; Gray, J. E. 1831.3; Günther, A. 1873.6, 7, 1874.6; Guichenot,

Fauna — Cont'd.

A. 1869.1; Jouan, H. 1866.2; Károli, J. 1882.1; Kaup, J. J. 1860.6; M'Clelland, J. 1844.1 (*Chusan I.*); Peters, W. C. 1864.1, 1878.1, 1880.2; Regan, C. T. 1905.2, 1908.11; Richardson, J. 1845.3, .4, .5, 1848.1; Sauvage, H. E. 1881.5 (*Swatow*); Seitz, A. 1892.1 (*Comparison with Japan*); Steindachner, F. 1867.5 (iv), .8. — *Hongkong I.* Jordan, D. S. & Seale, A. 1905.2, 1907.2; Jouan, H. 1867.1; Kner, R. 1864.4, 1865.3; Peters, W. C. 1880.3; Seale, A. 1914.1. — *Works of travel including references to Chinese fishes.* Doflein, F. J. 1906.2; Filippi, F. 1867.1; Osbeck, P. 1765.1, 1771.2; Tronson, J. M. 1859.1. — *Early reference to Chinese fauna.* Prey, A. Pre-Linn. 1655.1. **Fresh-water fauna:** Abbott, J. F. 1901.1 (*Tien-Tsin, Pei-Ho*); Basilewski, S. 1855.1; Berg, L. S. 1907.4; Boulenger, G. A. *Shanghai* 1892.2, *Hainan I.* 1899.11, *Ningpo.* 1901.6; Fowler, H. W. 1900.3, 1910.1; Günther, A. 1896.6 (*Kansu and Sze-Chuan Provs.*); Jordan, D. S., & Starks, E. C. 1903.1 (*Tientsin*); Kreyenberg, M. 1911.2; McClelland, J. 1844.1 (*Ning-po*); Martens, E. 1868.1 (*Shanghai*); Möllendorff, O. F. 1877.1 (*Chi-li Prov.*); Pappenheim, P. 1908.1; Popta, C. 1907.1; Regan, C. T. 1908.9; Rutter, C. M. 1897.1 (*Swatow*); Sauvage, H. E. 1878.2 (*Kiangsi Prov.*); Sauvage, H. E., & Dabry, P. 1874.1. — *Hongkong.* Steindachner, F. 1866.7. **Cochin China;** see under French Indo-China. **East Turkestan:** Day, F. 1876.3, 1878.5 (*Yarkand*); Herzenstein, S. M. 1888.1. — *Thian-Schan Mts.* Severtzov, A. N. 1873.1, 1875.1; Zugmayer, E. 1909.1, 1910.1, 1912.2, 1913.4. **Manchuria:** List. Berg, L. S. 1908.2. — *Niu-chuang.* Günther, A. 1898.1. — *Port Arthur.* Jordan, D. S., & Starks, E. C. 1906.2. — *Liao ho (river).* Morrison, W. 1898.1. **Mongolia:** Berg, L. S. 1906.6 (*Koso-gol lake*); Boulenger, G. A. 1898.11 (*Altai Mts.*); Kessler, K. T. 1876.1, 1879.1. — *Work of travel.* Przhevalskii, N. M. 1875.1. **Tibet:** Lloyd, R. E. 1908.3; Pappenheim, P. 1908.1; Regan, C. T. 1905.6, .8 (*Lhasa*); Stewart, F. H. 1911.1, .2 (*Chang and Yu Provs.*); Gray, J. E. Add. 1863.1. **Yang-tze-Kiang:** (river). Garman, S. 1912.1; Günther, A. 1888.1, 1898.9, Add. 1892.1; Handyside, P. D. 1875.1; Kreyenberg, M., & Pappenheim, P. 1908.1; Martens, E. 1862.1; Sauvage, H. E. 1878.2. **Yunnan:** Anderson, (Rev.) J. 1878.1; Chaudhuri, B. L. 1912.1; Regan, C. T. 1904.5, .7, 1906.7, 1907.6, 1908.10, 1914.6.

French Indo-China: *Fresh-water fauna.* Pellegrin, J. 1906.9, 1907.8; Sauvage, H. E. *Résumé*, 1877.1, *Tongking*, 1884.1. — *Tongking.* Vaillant, L. L. 1892.2, .5, 1893.4, 1904.1, .2. — *River Hué.* Tirant, G. Add. 1883.1. — *Littoral fauna, Condore I.* Jouan, H. 1866.1. — *Bay d'Along.* Pellegrin, J. 1905.6, 1907.6. **Cambodia:** *Chiefly fresh-water.* Günther, A. 1864.6; Pétillet, L. 1911.1; Sauvage,

H. E. (*Laos*) 1876.2, 1878.3, .5, 1879.1, 1880.6, 1881.4; Tirant, A. 1885.1. **Cochin China:** *Chiefly marine.* Filippi, F. 1867.1; Jouan, H. 1865.1; Károli, J. 1882.1; Sauvage, H. E. 1878.4, .5, 1879.1.

India: *General treatises.* ★Beavan, R. 1877.1; ★Day, F. 1865.1, 1875.1, 1888.6, 1889.1; Pennant, T. 1769.2, 1781.1; Russell, P. 1803.1. — *Relationship with African fauna.* Day, F. 1885.12. — *Works of travel, etc.* Afialo, F. G. 1904.3; Delessert, A. 1843.1; Jacquemont, V. 1841.1; Osbeck, P. 1765.1, 1771.2; Varthema, L. 1824.1. **Fresh-water fauna:** Annandale, N. 1906.1, 1912.1; Bassett-Smith, P. W. 1897.1; ★Beavan, R. 1877.1 (*Handbook*); Blanford, W. T. 1901.1; Bloch, M. E. 1788.2; Blyth, E. 1860.1 (*Sitang R.*); Buckland, C. T. 1889.1; Chaudhuri, B. L. 1910.1, 1912.2, .3, 1913.1; ★Day, F. 1867.4, 1869.1, 1871.5, .6, .7, 1876.2, 1880.7, 1888.2; Falconer, H. 1868.1; Fowler, H. W. 1912.1; Jenkins, J. T. 1909.1; Jerdon, T. C. 1848.1, 1851.1; Kinnear, N. B. 1910.1; M'Clelland, J. 1838.1, 1839.1, .2, 1842.1, 1845.1, .2; McMahon, A. H. 1901.1, .2 (*Chitral and Swat*); Playfair, R. L. 1867.2 (*Cachar*); Regan, C. T. 1914.12 (*Waziristan*); Seymour-Sewell, R. B., & Southwell, T. 1913.1; Sykes, W. H. 1838.1, 1840.1. **Marine fauna:** (*chiefly*). Alcock, A. W. 1889.1–1905.1, *List.* 1896.1; Alcock, A. W., & McGilchrist, A. C. 1892.1; Anderson, J. 1800.1; Annandale, N. 1907.1, Add. 1901.1; Barton, E. L. 1898.1; Blyth, E. 1861.1; Cantor, T. E. 1839.1, 1853.1; ★Day, F. 1865.1–1877.1, 1878.2, 1888.2, 1888.6, 1889.1; Forster, J. R. 1781.1; Gordon, G. 1910.1 (*Bengal, Tirhoot*); Gray, J. E. 1831.4, .5; Jenkins, J. T. 1910.1, .2; Kner, R. 1864.4, 1865.3 (*Madras*); Murray, H., Wilson, J., & others. 1840.1; Seba, A. 1758.1; Seymour-Sewell, R. B. 1914.1; Steindachner, F. 1867.4 (*Simla*); Thompson, W. 1840.2; *Rameswaram I.* Thurston, E. 1887.1. **Burma:** *Fresh-water fauna.* Blanford, W. T. 1901.1; Boulenger, G. A. 1893.2, 1894.1; Chaudhuri, B. L. 1908.1; Day, F. 1869.2, 1870.1, 1871.5, 1873.3; Fea, L. 1897.1; Mason, F. 1860.1 (*Catalogue*); Regan, C. T. 1907.1; ★Vinciguerra, D. (*Irrawaddy R.*) 1879.1, *Bhamo.* 1889.1. — *Marine fauna.* Chaudhuri, B. L. 1908.2; ★Day, F. 1870.1, 1873.3, 1875.1, 1889.1; Lloyd, R. E. 1907.3 (*Akyab*). — *Rangoon.* Vinciguerra, D. 1889.1. **Ganges R.:** Buchanan, F. 1822.1; Peters, W. C. 1861.1; Storer, D. H. 1844.15. **Kashmir:** (State) Heckel, J. J. 1838.1; Huegel, C. A. 1844.1; Schlagintweit, H. 1879.1; Steindachner, F. 1866.18. **Nepal:** (State) Boulenger, G. A., Annandale, N., Wall, E., & Regan, C. T. 1907.1; Günther, A. 1861.3; Regan, C. T. 1907.9; Gray, J. E. Add. 1863.1. **Sind (Prov.) Karachi:** *Marine fauna.* Boulenger, G. A. 1898.3; Buist, G. 1850.1; D'Souza, V. 1872.1; Murray, J. A. 1884.1, 1887.1; Regan, C. T. 1905.12.

India, Further; see French Indo-China.

Indian Ocean: Alcock, A. W. 1891.1, 1892.3, 1893.1, 1894.1, 1899.1, 2, 1901.1, 1902.1, Add. 1890.1; Annandale, N. 1909.1, 1910.1; Danckelmann, E. 1880.1; Lloyd, R. E. 1907.1, 1909.1; Regan, C. T. 1908.17; Seymour-Sewell, R. B. 1912.1, 1913.1. **Bay of Bengal:** Alcock, A. W. 1889.1–1905.1; Annandale, N. 1906.1, 1907.1; Bleeker, P. 1853.13, 1859.7, 1875.3, 1877.12, 1878.2; Bogle, — 1842.1; Chaudhuri, B. L. 1909.1; Day, F. 1873.1, 1877.1; Jenkins, J. T. 1912.1; Lloyd, R. E. 1908.1; Piddington, H. 1835.1.

Islands of Indian Ocean

Aldabra I.: Jefferson, J. P. 1878.1; Regan, C. T. 1912.12. **Andaman Is.:** Day, F. 1870.5, 6. **Assumption I.:** Regan, C. T. 1912.12. **Ceylon I.;** see above. **Chagos Is.:** Boulenger, G. A. 1909.7; Brauer, A. 1902.1. **Jaffna I.;** see above under Ceylon. **Keeling Is. (Cocos Is.):** Anderson, A. J. 1859.1; Bleeker, P. 1854.2, 21, 1855.7, 19, 1858.17, 1859.29, 41, 1860.16, 29; Jenyns, L. 1842.1; Jones, F. W. 1909.1, Add. 1912.1. **Laccadive Is.:** Alcock, A. W. 1894.1; Gardiner, J. S. 1906.1. **Madagascar I.;** see under Africa. **Maldivé Is.:** Parker, G. H. 1904.3; Regan, C. T. 1902.2. **Mauritius I. (Île de France), Chiefly marine.** Bennett, E. T. 1831.2, 1832.3, 1833.1, 1835.2; Bleeker, P. 1877.13, 1879.1; Bliss, R. 1883.1; Bory de Saint-Vincent, J. 1804.1; Desjardins, J. F. 1840.1; Günther, A. 1887.1, 1891.1; Möbius, K. A. 1877.1, 1880.1; Möbius, K. A., & Peters, W. 1883.1; Liénard, E. 1836.1, 1840.1; Lunel, G. 1881.1; Peters, W. C. 1876.3; Pike, N. 1873.1; Regan, C. T. 1903.3; Robillard, V. 1876.1; Sonnerat, P. 1782.1, 1783.1; Sonnerat, P., & Meunier, V. 1774.1; Telfair, — 1835.1; Anon. 411. — *Work of travel.* Pike, N. Add. 1873.1. **Nicobar I., Nancowry.** Day, F. 1870.3. **Réunion or Bourbon I.** Bleeker, P. 1866.3, 8, 1868.2, 3, 7, 15, 1869.4, 7, 1873.3, 13; Bleeker, P., & Pollen, F. P. 1874.1, Add. 1875.1; Bory de Saint-Vincent, J. 1804.1; Guichenot, A. 1863.1; Sauvage, H. E. 1884.7; Thominot, A. 1878.1; Valenciennes, A. 1862.1. **Rodriguez I.** Günther, A. 1879.4. **St. Paul I.** Sauvage, H. E. 1875.5, 1876.1, 1879.2. **Seychelles Is.** Boulenger, G. A. 1909.7; Günther, A. 1869.9; Möbius, K. A. 1880.1; Möbius, K., & Peters, W. 1883.1 (*List*); Peters, W. C. 1876.3; Playfair, R. L. 1867.1; Ward, Swinburne. 1869.1. **Sokotra I.** Steindachner, F. 1902.1, 1902.4; Forbes, H. O. Add. 1903.1.

Japan: General treatises. ★Jordan, D. S., Tanaka, S., & Snyder, J. O. 1913.1; ★Otaki, K., Fujita, T., & Higurashi, T. 1903.1; Siebold, P. F. 1824.1, 1826.1; ★Temminck, C. J., & Schlegel, H. Add. 1842.1. — *Review of Jordan, Tanaka & Snyder.* Hussakof, L. 1914.4. — *Early nat. hist.* Kaempfer, E. Pre-Linn. 1727.1.

— *Catalogues, check-lists, etc.* Bleeker, P. 1879.2; Jordan, D. S., & Snyder, J. O. 1901.6; Owston, A. 1905.1; Okada, S. Add. 1891.1. — *Works of travel, etc.* Evermann, B. W. 1906.4, 1907.7; Filippi, F. 1867.1; Tronson, J. M. 1859.1. **Bibliography:** *works relative to Japan, etc.* Gabelentz, H. G. 1862.1; Giussani, C. A. 1886.1; Mechnikov, L. 1873.1; Pagès, L. 1859.1; Rosny, L. L. 1861.1; Valenziani, C. 1877.1; Wenckstern, F. 1895.1. **Fresh-water fauna:** Baldwin, C. H. 1884.1; Fowler, H. W. 1910.1; Martens, E. 1868.1 (*Yokohama*); Regan, C. T. 1905.7, 11, 1908.9. — *Shinano (Prov.).* Tanaka, S. 1909.3, 4. **Biwa lake:** Ishikawa, C. 1895.1, 1901.1; Sauvage, H. E. 1883.5; Tanaka, S. 1908.2, 7. **Marine fauna:** (*Chiefly*) *of various localities.* Baldwin, C. H. 1884.1; Bean, B. A. 1905.3; Bean, T. H., & Bean, B. A. 1896.1, 1897.1; Bellotti, C. 1892.2, 1903.1; Bleeker, P. 1853.12, 1854.5, 12, 1858.15, 1859.7, 20, 1860.27, 36, 1862.5, 1863.25, 1865.5, 1869.6, 1873.9, 15, 25, 1877.12, 13, 1879.2; Brevoort, J. C. 1856.1; Dean, B. 1904.7, 8; Döderlein, L. 1882.1, 2; Doflein, F. J. 1906.1, 2; Engelhardt, R. 1913.1; Franz, V. 1910.4; Fujita, T., & Otaki, K. 1904.1; Garman, S. 1884.5; Gilbert, C. H. 1913.2; Gilbert, C. H., & Burke, C. V. 1912.2; Gill, T. N. 1860.8; Günther, A. 1877.6, 1878.1; Hatta, S. 1901.1; Hikida, T. 1913.1; Hilgendorf, F. M. 1878.2, 3, 1879.2, 1880.2, 3, 4, 1892.1; Houttuyn, M. 1782.1; Hussakof, L. 1909.1, 1910.3; Ishikawa, C. 1904.1, 1908.1; Ishikawa, C., & Matsuura, K. 1897.1; Jeffreys, J. G. 1876.1; ★Jordan, D. S. 1898.2, 1901.2, 1902.3, 1906.1, 1907.4, 5, 1913.1; Jordan & Dickerson, 1908.1; Jordan & Fowler, 1902.1–1903.6; Jordan & Gilbert, 1904.1; Jordan & Herre. 1906.1–1907.2; Jordan & McGregor. 1906.1; Jordan & Richardson. 1907.2, 1910.2; Jordan & Seale. 1906.1; Jordan & Sindo. 1902.1–2; Jordan & Snyder. 1901.1–4, 7–12, 1902.1–7, 1906.1–2; Jordan & Starks. 1901.1, 3, 1903.1–5, 1904.2, 3, 1906.3, 1907.2; Jordan & Thompson. 1911.1, 2, 1912.1, 1914.1; Jouan, H. 1869.1; Károli, J. 1882.1; Kaup, J. J. 1863.3; Kishinouye, K. 1901.1–3, 1902.1, 1904.2, 1905.1, 1907.1, 2, 1908.2; Kitahara, T. 1897.1; McIntosh, W. C. 1904.1, 1909.1; Nichols, J. T. 1913.4; Nyström, E. 1887.1; Otaki, K. 1897.1; Peters, W. C. 1865.3; Peters, W. C., & Steindachner, F. 1864.1; Pietschmann, V. 1907.2, 1908.3, 5, 1909.1; Radermacher, J. C. 1782.1; Regan, C. T. 1905.7, 11; Remy, C. 1883.1; Richardson, J. 1845.4, 1848.1; Schlegel, H. 1842.1; Seitz, A. 1892.1; Sauter, H. 1905.1; Smith, H. M. 1902.2; Smith, H. M., & Pope, T. C. 1906.1; Snyder, J. O. 1907.1, 1908.1, 1909.1, 1911.1, 1912.3; Steindachner, F. 1881.1, 2, Add. 1892.1; ★Steindachner, F., & Döderlein, L. 1883.1; Tanaka, S. 1908.1, 4, 5, 6, 1909.1, 2, 1910.1; Thunberg, C. P. 1790.1, 1792.2; Tilesius, W. G. 1812.1. **Bonin Is.:**

Fauna — Cont'd.

Kishinouye, K. 1911.1; Tanaka, S. 1911.2. **Formosa I.:** *General and marine.* Hilgendorf, F. M. 1904.1; Jordan, D. S., & Evermann, B. W. 1903.1; ★Jordan, D. S., & Richardson, R. E. 1909.1 (*Catalogue*); Jordan, D. S., & Snyder, J. O. 1908.1; Pietschmann, V. 1911.1; Tanaka, S. 1911.2. — *Fresh-water fauna.* Boulenger, G. A. 1894.2; Pellegrin, J. 1908.9; *Lake Candidius.* Regan, C. T. 1908.8, 9; Steindachner, F. 1908.1. — *Work of travel.* Mackay, G. L. Add. 1906.1. **Hokkaido:** Fritze, A. 1891.1; Hatta, S. 1913.1; Herzenstein, S. 1892.1. **Kiusiu I.:** Nakagawa, H. 1897.1; Tanaka, S. 1904.2. **Kurile Is.:** Kracheninnikov, S. P. 1764.1–1768.1; Tanaka, S. 1911.2. **Riu-Kiu Is.:** Jordan, D. S., & Starks, E. C. 1907.1; Snyder, J. O. 1908.1, 1909.1, 1911.1, 1912.1; Tanaka, S. 1911.2. **Shikoku I.:** Jordan, D. S., & Thompson, W. F. 1913.1. **Tanaga and Yaku Is.:** Jordan, D. S., & Starks, E. C. 1906.1. **Yezo I.;** see Hokkaido.

Korea: Berg, L. S. 1906.2, 1907.3, 13, *Toumen-Oula R.* Add. 1914.3; ★Jordan, D. S., & Metz, C. W. 1913.1 (*Catalogue*); Jordan, D. S., & Starks, E. C. 1905.1; Regan, C. T. 1908.12; Tanaka, S. 1911.1, 2; Shimokoriyama, S. Add. 1914.1.

Liu-Kiu Is.; see Riu-Kiu Is. under Japan.

Malay Peninsula: *List.* Cantor, T. E. 1849.1. — *Penang.* Bleeker, P. 1861.5. — *Patani R.* Boulenger, G. A. 1903.11; *Johore.* Hutchinson, R. F. 1880.1. — *Jhering and Patani.* Johnstone, J. 1903.2. — *Johore.* Regan, C. T. 1913.14. — *Pérak (State).* Sauvage, H. E. 1884.2. — *Malacca.* Sonnerat, P. 1782.1, 1783.1; Zograf, N. Y. 1902.3. See also Siam. For Singapore I., see Indo-Australian Archip. under Oceanica.

Persia: *Fresh-water fauna.* Berg, L. S. 1913.2; Blanford, W. T. 1876.1; Filippi, F. 1862.1, 1865.1; Jenkins, J. T. 1910.1; Keyserling, E. 1861.1; Nikolskii, A. M. 1897.1, 1899.1, 1900.3; Zarudnii, N. A. 1904.1. — *Lake Urumiah. (Salt Lake)* Günther, A. 1899.3; Wilbraham, R. 1839.1. — *Marine fauna.* Boulenger, G. A. 1897.5; Regan, C. T. 1905.12. For Caspian Sea, see under Europe, Russia. — *Works of travel.* Olivier, G. A. 1802.1; Varthema, L. 1824.1; Laet, S. V. Pre-Linn. 1667.1.

Philippine Is.; see under Oceanica.

Russian Central Asia: *Fresh-water fauna.* Berg, L. S. 1898.1, 1912.4, 1913.7 (*Akmolinsk Prov., Noura and Sary-su rivers*); Bergroth, E. E. 1880.1 (*Irtys R.*); Lansdell, H. 1885.1; Lönnberg, A. J. 1900.2; Meissner, V. I. 1908.2 (*Uralsk Prov. Kamish Samara lakes*); Nikolskii, A. M. 1886.1, 1903.3 (*Balkash Lake*); Sedelnikov, A. 1904.1 (*Akmolinsk Prov., Omsk*). — *Pont-Aral-Caspian region as a zoögeographical province.* Sowinsky, W. 1904.1. **Aral Sea:** Berg, L. S. 1900.2, 1908.5; Kessler, K. T. 1877.1; Nikolskii,

A. M. 1887.1. **Caspian Sea;** see under Europe, Russia. **Issik-Kul (Lake):** Günther, A. 1889.4; Herzenstein, S. M. 1896.2; Tarnaniĭ, I. K. 1911.1. **Turkestan:** Baer, K. E. 1874.1; Baird, S. F. 1873.29; ★Berg, L. S. 1905.2, 4, 1909.2; ★Herzenstein, S. M. 1888.1, 1889.1, 1892.1; Kessler, K. T. 1872.1–1874.2, 1879.1, Add. 1874.2. — *Pamir.* Alcock, A. W. 1898.2; Herzenstein, S. M. 1888.1. — *Syr Daria R.* Berg, L. S. 1900.2; Grünberg, V. 1905.1. — *Works of travel.* Fedtschenko, A. P. 1874.1; Ostroumov, A. A. 1890.1; Smirnov, N. 1907.1. **Ural River:** Navozov, N. 1912.1; Sabanyeev, L. P. 1872.1 (*Catalogue*); Anon. 216, 604.

Siam: *Chiefly marine.* Bleeker, P. 1860.31, 1864.6, 1865.1, 16, 21, 22; Károli, J. 1882.1; Milne-Edwards, A. 1866.1; Mortensen, O. T. 1901.1. — *Fresh-water fauna.* Bocourt, F. 1866.1; Günther, A. 1864.6. — *Menam R.* Sauvage, H. E. 1883.6.

Siam, Lower; see Malay Peninsula.

Siberia: *General and marine fauna.* Anikin, V. P. 1903.1, 1905.1; Bean, T. H. 1881.1; Bean, T., & Bean, B. 1897.2 (*Commander Is.*); Eversmann, E. W. 1835.1; Finsch, F. H. 1880.1; Hatta, S. 1901.1; Nordenskiöld, A. E. 1877.1; Nordmann, A. 1856.1, 1857.2 (*Nikolaievsk*); Pavlenko, M. N. 1910.1 (*Peter the Great Bay, Gen. treat.*); Schmidt, P. J. 1903.1, 1904.2, 4, Add. 1903.1. — *Works of travel.* Leche, W. 1904.1; Middendorff, A. T. 1848.1. **Fresh-water fauna:** Alenitsin, V. D. 1873.1–1880.1 (*Irkutsk, Troizkosavskii Lake*); Berg, L. S. 1908.4 (*Kolyma R., List*); Brandt, J. F. 1859.1; Bunge, A. 1883.1 (*Lena R.*); Bush, R. J. 1871.1; Dunin-Gorkavič, A. A. 1904.1; Dybowski, B. I. 1869.1 (*Ingoda and Onon Rivers*); Jordan, D. S., & Thompson, W. F. 1910.3 (*Irkutsk*); Nikolskii, A. M. 1902.3 (*Tomsk Govt., Altai*); Norden-skiöld, A. E. 1877.1 (*Yenisei R.*); Peters, W. C. 1877.1. — *Lake Teletskoi or Altin.* Varpakhovskii, N. A. 1889.3, 1900.1. **Amur:** *Province and River. — General treatise.* ★Berg, L. S. 1909.3. — *Various localities.* Berg, L. S. 1907.6, 1913.11 (*Hanka Lake*); Brashnikov, V. 1907.1. — *Amur River.* Berg, L. S. 1906.11, 1907.1, 9, 10, 11, 1912.6, 1913.8; Dybowski, B. I. 1872.1; Herzenstein, S. M., & Wapachowski, N. 1887.1; Popta, C. M. 1911.1; Soldatov, V. K. 1910.1; Steindachner, F. 1867.4, 5. **Baikal Lake:** Alenitsin, V. D. 1873.1–1880.1; Berg, L. S. 1900.1, 1903.1, 1906.8, 12, 1907.2; Dybowski, B. I. 1869.1, 1874.1, 1907.1; Gracianov, V. I. 1901.1, 1902.2; Grube, A. E. 1875.1; Jachontov, G. 1904.1; Korotnev, A. 1902.1–1905.1; Pellegrin, J. 1900.3; Georg, J. G. Add. 1775.1. **Beering Is.:** see Alaska under America. **Kamchatka:** *General and marine fauna.* Bean, T. H., & Bean, B. A. 1896.1; Boulenger, G. A. 1892.1; Collett, R. 1894.1; Evermann, B. W. 1907.7; Gilbert, C. H., & Burke, C. V. 1912.1; Grebnitski, N.

1897.1; Herzenstein, S. 1892.1; Kittlitz, F. H. 1858.1; Kracheninnikov, S. P. 1764.1-1768.1; Steller, G. W. 1774.1, 1809.1; Tilesius, W. 1810.1, 1813.1, 1814.1; Tronson, J. M. 1859.1; Tuhoff, V. N. 1806.1; Steller, G. W. Pre-Linn. 1753.1. — *Fresh-water fauna*. Berg, L. S. 1912.5; Chappe d'Auteroche, J. 1768.1; Koshida, T. 1910.1; Tanaka, S. 1904.3. **Obi River**: Berg, L. S. 1908.3 (*List*); Bergroth, E. E. 1880.1; Derjugin, K. M. 1898.2; Derjugin, K., & Drzhevetskič, V. 1898.1; Dunin-Gorkavič, A. A. 1904.1; Varpakhovskii, N. A. 1899.1. **Sakhalin I.**: Boulenger, G. A. 1907.13; Nikolskii, A. M. 1889.1; Tanaka, S. 1908.3, 1911.2. **Vladivostock**: (*Maritime Prov.*) Berg, L. S. 1913.11; Hatta, S. 1901.1; Herzenstein, S. 1892.1; Popta, C. 1911.1.

Turkey: *General and marine fauna*. Bennett, E. T. 1835.3 (*Trebizond*); Gaillard, C. 1895.1; Leidenfrost, G. 1912.1; Richardson, J. 1856.2; Werner, Franz. 1909.1 (*Tripolis*); Wilde, W. R. 1840.1. — *Aleppo (Early ref.)*: Russell, A. Pre-Linn. 1756.1. — *For Black Sea, see Russia under Europe*. **Fresh-water fauna**: Boulenger, G. A. 1890.2, 1896.7; Steindachner, F. (*Arsus*) 1863.8 (*Angora Prov.*), 1897.1. — (*General treatise*). Tchihatcheff, P. 1856.1. — *Kurdistan*. Gavinus, — 1859.1; Sauvage, H. E. 1882.1. — *Lake Van (Salt lake)* Deyrolle, T. 1871.1; Wilbraham, R. 1839.1. — *Mesopotamia, Tigris R.* Günther, A. 1874.1; Pietschmann, V. 1913.2. **Scio I.**: Giglioli, E. H. 1888.1. **Syria**: Forskål, P. 1775.1, 1776.1; Gaillard, C. 1895.1; Heckel, J. J. 1841.1, 1843.1; Hemprich, F. G., & Ehrenberg, C. G. 1899.1; ★Lortet, L. 1883.1 (*Lake Antioch and Lake Homs*); Pellegrin, J. 1911.7; Sauvage, H. E. 1882.1. — *Works of travel*. Varthema, L. 1824.1; Wilde, W. R. 1840.1. **Palestine**: Coco-Zanghy, G. 1877.1; Günther, A. 1864.13, 1869.6; Richardson, J. 1856.2; Tristram, H. B. 1884.1. — *Travel, etc.* Wilde, W. R. 1840.1; Anon. 219; Hasselquist, F. Pre-Linn. 1757.1. **Lake Tiberias or Sea of Galilee**: Ainsworth, W., Tristram, H., & Kingsley. 1865.1; Annandale, N. 1913.1; Hull, E. 1885.1, 1895.1; ★Lortet, L. 1883.1; Aharoni, J. Add. 1912.1.

EUROPE

General treatises

"*Histoire naturelle des poissons d'eau douce de l'Europe Centrale*." Agassiz, J. L. 1830.1, 1839.3

"*Die Süßwasserfische von Mitteleuropa*." ★Bade, E. 1901.2; Hein, W., & Winter, F. W. 1912.1; Hofer, B. 1909.1; Schulze, E. 1889.1-1892.1; ★Siebold, C. T. 1863.1, 1878.1; Walter, E. 1913.1 — *Comments on Siebold*. Baird, S. F. 1876.14; Lori, F. A. 1878.1

Europäische Fauna oder die Wirbelthiere Europa's. Goeze, J. A. 1794.1; Keyserling, A., & Blasius, J. 1840.1; Schinz, H. R. 1840.1; Schmiedeknecht, O. 1906.1

"*The fresh-water fishes of Europe*." ★Seeley, H. G. 1886.1

Catalogues

Catalogo metodico dei pesci Europei. Bonaparte, C. L. 1845.2 — *Catalogue des poissons du nord de l'Europe avec les noms vulgaires*. Hoek, P. P. 1904.1

ANDORRA

Republic: Marcaillou-d'Ayméric, H. 1899.1,2

AUSTRIA-HUNGARY

General treatises, catalogues, etc. Fitzinger, L. 1832.1; Fritsch, A. J. 1859.2, 1868.1, 1871.1, 1872.1; ★Heckel, J. J., & Kner, R. 1858.1; Henschel, G. 1890.1; Mojsisovics, A. 1887.1; Grassinger, J. B. Add. 1793.1 — *Cave fauna*. Grochowski, M. 1901.1 — *Bibliography of Austrian zoology, 1850-1900*. Steindachner, F. 1901.2 — *Early reference*. Kramer, W. H. Pre-Linn. 1756.1

Austria, Lower: *Lunzer-See and Er-laph-See*. Fitzinger, L. 1878.1; *Lunzer-See and Ybbs R.* Hütter, J. 1874.1; *Allensteig*. Kammerer, P. 1901.1; *Vienna (Synopsis)*. Mauduyt, F. 1853.1

Austria, Upper: Heckel, J. J. 1851.4; Kukula, W. 1874.1

Bohemia: Car, L. 1911.1; Fritsch, A. J. 1859.1, 1863.1, 1873.2,3, 1908.1; Goode, G. B. 1877.1 (*Beraun R.*); Mayer, J. 1791.1; Schmidt, F. W. 1795.1 (*Synopsis*); Woldrich, J. H. 1858.1; Fritsch, A., & Vavra, V. Add. 1901.1; Balbinus, B. Pre-Linn. 1679.1

Bosnia: Heckel, J. J. 1852.1 (*Save R.*); Heintz, K. 1910.1; Werner, Franz. 1904.2; *Donja Dolina*. Woldrich, J. N. 1904.1

Carinthia: *Faukersee*. Hartmann, V. 1886.1, 1899.1

Carniola: Freyer, H. 1842.1

Croatia and Slavonia: Brusina, S. 1892.1-1902.1; Jurinac, A. E. 1887.1; Katuric, M. 1887.1, 1891.1, 1896.1; Kosič, N. B. 1898.1; Langhoffer, A. 1904.1; Medič, M. 1901.1; Mojo, M. 1896.1; Steindachner, F. 1863.11, 1866.8, .15; Vutskits, G. 1901.1, 1904.1

Dalmatia: *Fresh-water fauna*. Brusina, S. 1888.2, 1891.1; Katuric, M. 1899.1; Werner, Franz. 1908.1 — *Marine fauna*. Kolombatović, J. 1881.1-1902.1; Leidenfrost, G. 1908.1, 1912.2; Ninni, A. P. 1862.1; *Meleda I.* Vinciguerra, D. 1883.2. See also *Adriatic Sea under Mediterranean*.

Danube River: Berg, L. S. 1907.14; Heckel, J. J. 1852.4; Károli, J. 1877.1; Martens, G. 1824.1; Reuss, L. 1832.1; Steindachner, F. 1863.3; Steuer, A. 1901.1; Tchihatcheff, P. 1856.2; Vutskits, G. 1912.1, 1914.1; Walter, E. 1910.1; Anon. 442. — *Early references in Pre-Linn. section*. Brown, E. 1673.1; Hohberg, W. 1701.1; Marsigli, L. F. 1744.1

Galicia: Bart, M. A. 1877.1, 1883.1,2 (*Dniester and Pruth R.*); Lomnicki, A. M. 1878.1; Niezabitowski, E. L. 1901.1, 1902.1; Norwicki, M. 1880.4; Rozwa-

Fauna — Cont'd.

dowski, J. 1901.1–1906.2; Rozwadowski, T. 1904.1, 1908.1; Wierzbowski, M. 1880.1 (*Pruth R.*); Zavadski, A. 1840.1 (*Vistula R.*); Anon. 479.

Görz and Gradiska: *Isonzo R.* Glowacki, J. 1896.1; Steindachner, F. 1861.4

Herzegovina: Heintz, K. 1910.1; Steindachner, F. 1882.1, 1896.1; Werner, Franz. 1904.2

Hungary: *Catalogues, general treatises, etc.* Károli, J. 1879.1; Schmidt, L. 1887.1; Grossinger, K. J. Add. 1793.1 — *Bibliography of zoological contributions.* Szinnyi, J. 1878.1 — *Various papers.* Bielz, E. A. 1853.1, 1856.1, 1888.1; Chyzer, K. 1882.1; Daday, J. 1885.1; Desco, B. 1902.1 (*Hernád R.*); Horvath, J. 1896.1; Jeitteles, L. H. 1861.2, 1862.1; Kornhuber, G. A. 1860.1, 1863.1; Mocsáry, S. 1874.1; Mojsisovics, A. 1884.1; Reisinger, J. 1830.1; Varpakhovskii, N. A. 1883.1 (*Kis küküllő R.*); Vutskits, G. 1901.1, 1903.1, 1904.1, 1911.1; Klein, M. Add. 1778.1; Brown, E. Pre-Linn. 1673.1

Balaton Lake (Plattensee.) Daday, J. 1896.1, Add. 1897.1; Rátz, S. 1893.1; Vutskits, G. 1907.1, 1913.1, Add. 1895.1–1913.2

Istria: *Marine fauna, chiefly Gulf of Trieste.* Burckhardt, C. R. 1911.2; Gaál, S. 1905.1; Graeffe, E. 1886.1; Grube, A. E. 1864.1 (*Lussin I.*); Stiasny, G. 1910.1, Add. 1911.1

Moravia: Heinrich, A. 1856.1; Jeitteles, L. H. 1863.1; Laus, H. 1901.1–1910.1; Schwarz, J. 1911.3 (*Sternbergersee*); T. M., 1866.1; Zila, F. 1879.1

Salzburg: Aigner, J. 1859.1; *Salzach R.* Heckel, J. J. 1854.3; *Faistenauer Lake.* Micoletzky, H. Add. 1911.1

Silesia: Kaluza, A. 1815.1; Laus, H. 1901.1–1910.1; Zila, F. 1879.1

Styria: Mojsisovics, A. 1884.1, 1889.1

Tyrol: *General treatises.* Heller, C. 1869.1, 1871.1; Huber, G. 1905.1 (*Montigglersee*); Largaiolli, V. 1901.1, 1902.1 — *Other papers.* Canestrini, A. 1913.1; Canestrini, R. 1885.1; Giglioli, E. H. 1902.1; Heckel, J. J. 1851.1, 1852.5

Vorarlberg: Bruhin, P. T. 1868.1; Heller, C. 1871.1

AZORES ISLANDS

General treatises, lists, etc. Capello, F. 1871.1; Godman, F. D. 1870.1; Guimaraes, A. R. 1884.2, 1885.2 — *Other papers.* Barrois, Th. 1896.1; Collett, R. 1889.1, 1896.1, 2, 1897.2, 1905.2; Drouet, H. 1861.1; Hilgendorf, F. M. 1888.3, 1888.4; Regan, C. T. 1903.6

BALEARIC ISLANDS

Catalogues. Barceló y Combis, F. 1868.1, 1875.1; Navarrete, A. 1900.1 — *Other papers.* Armstrong, G. 1781.1; Bolivar, I. 1903.1; Buen y del Cos, O. 1905.1; Buen y del Cos & Fage, L. 1908.1; Delaroche, F. E. 1809.1, 4; Fage, L.

1907.2; Ferrer y Hernández, J. 1903.1; Lasiera, D. J. 1781.1; Perez Arcas, L. 1872.1; Racovitza, E. G. 1905.1; Ramis y Ramis, D. J. 1814.1; Willkommen, H. M. 1879.1; Armstrong, J. Pre-Linn. 1752.1; Cleghorn, G. Pre-Linn. 1751.1

BALTIC SEA

General account. Marshall, W. A. 1898.1 — *Planktonic fauna of Baltic Sea.* Ehrenbaum, E., & Strodtmann, S. 1904.1; Heinen, A. 1912.1; Merkle, H. 1910.1; Ostenfeld, C., & Wesenberg-Lund, C. 1909.1; Strodtmann, S. 1906.1 — *Comparison with Caspian Sea.* Lönnberg, A. J. 1899.6 — *Physical conditions.* Karsten, G. 1880.1, 1882.1; Schneider, G. 1907.8 — *Geographical distribution.* Streiff, R. 1910.1 — *Various papers.* Duncker, G. 1891.2; Heincke, F. 1878.1, 1880.1; Knipovich, N. M. 1909.1; Meyer, H. A. 1872.1–1878.1; Meyer, H. A., & others. 1882.1; Möbius, K. A. 1872.1, 1873.1; ★Möbius, K. A., & Heincke, F. 1875.1–1883.1; Nettelbladt, V. 1885.1; Otterström, A. N. 1906.3; Petersen, C. G. 1893.4; Reibisch, J. 1904.1, 1907.1, 1911.1; Schneider, G., & Björk, W. 1910.1 — *See also under surrounding countries.* For Gulf of Finland, see Nyland under Russia, Finland.

BELGIUM

General treatises: "Atlas de poche des poissons d'eau douce." Raveret-Wattel, C. 1900.1; " . . . poissons de mer." Add. 1909.1; "Faune belge." Selys-Longchamps, M. 1842.1, 1887.1 — *Fresh-water fauna.* Bamps, C., & Geraets, E. 1897.1; Carlier, -. 1831.1; Dollo, L. 1896.1; Gens, E. 1885.1; Kemna, Ad. 1905.1; ★Selys-Longchamps, M. 1887.1 — *Marine fauna.* Beneden, E. 1883.1; Beneden, P. J. 1851.1, 1852.1, 1853.4, 1857.1, 1865.1, 1871.1, 1873.1; Gronovius, L. T. 1760.2, Add. 1760.1; Gilson, G. Add. 1907.1; Anon. 698.

BLACK SEA

General treatises. ★Kessler, K. T. 1856.1–1859.2, 1861.1 — *Various papers.* Antipa, G. 1905.1, 1906.1, 1908.1; Berg, L. S. 1908.6, 1911.1, 3, 1913.10; Borodin, N. A. 1896.1; Brauner, A. 1912.1, 2; Chichoff, G. 1912.1; Haupt, H. 1904.1; Jagodowski, K. P. 1909.1; Maksimov, N. E. 1909.1, 1912.1; Nordmann, A. 1840.1; Sodoffsky, W. 1849.1; Zernov, S. A. 1909.1, 1913.1 — *Sea of Azov.* Alpheraki, S. 1906.1; Grimm, O. 1901.1; Ostroumov, A. A. 1896.2, 1897.1; Pengo, K. K. 1870.1 — *See also under surrounding regions.*

BRITISH ISLES

Including Channel, Hebrides, Orkney and Shetland islands. *See also* North Sea.

General treatises.

Popular general treatises: *Natural history of British fishes: handbooks, manuals, etc.* ★Aflalo, F. G. 1904.1; Berkenhout, J. 1795.1; Bewick, T. 1862.1, 1887.1; Buckland, F. T. 1857.1, 1859.1, 1873.1,

1881.1, 1891.1; Donovan, E. 1802.1; Fleming, J. 1828.1; Gordon, W. J. 1902.1; Jenyns, — 1835.1; Kent, W. S. 1883.1

Fresh-water fishes of the British Isles. Bowdich, T. E. 1828.1; Cholmondeley-Pennell, H. 1863.1, 1886.2, Add. 1884.1; ★Houghton, W. 1879.1; ★Maxwell, H. E. 1904.1, 1912.1; ★Regan, C. T. 1911.8; Wood, Wm. 1842.1

Marine food-fishes of the British Isles, etc. Gosse, P. H. 1885.1; Houghton, W. 1883.2; ★McIntosh, W. C., & Masterman, A. T. 1897.1; Swithinbank, H., & Bullen, G. E. 1916.1

Technical general treatises: History of British fishes, etc. ★Couch, J. 1862.2; ★Cunningham, J. T. 1896.1; Day, F. 1880.2; Hamilton, R. 1843.1, 1852.1, 1860.1, 1876.1; ★Pennant, T. 1769.1; ★Yarrell, W. 1836.1, 1860.1

Lists of British fishes. Herdman, W. A. 1893.1; MacLagan, N. 1884.1; Turton, W. 1807.1; W., S. D. 1836.1; White, A. 1851.1

Bibliography: Catalogue of local lists, arranged by counties. Christy, R. M. 1893.1; *List of publications of the Marine Biological Association, 1886–1913.* Anon. 343.

Channel Islands

Carrington, J. 1881.1; Wilcocks, J. 1877.1; Sinel, J. 1906.1

England

Popular natural histories, sporting treatises, etc. Davy, J. 1857.1; Gallichan, W. M. 1908.1; Grimble, A. 1904.1; Miller, S. H., & Sketcherly, S. B. 1878.1; Sinel, J. 1906.2

Miscellaneous and general: definite localities not indicated. Day, F. 1887.7; DuBois-Reymond, E. 1883.1; Garstang, W., & Browne, F. 1900.1; Günther, A. 1861.2, 1862.1; Holt, E., & Byrne, L. 1903.1–1913.1; Kemp-Welch, E. B. 1879.1; Stubbs, F. J. 1913.1 (*Fishes of London markets*); Yarrell, W. 1830.1; Crawshay, L. R. Add. 1912.1

Early references in Pre-Linn. section. Caius, J. 1570.1; Drayton, M. 1613.1; Griffiths, R. 1746.1; Lovell, R. 1661.1; Pettiver, J. 1695.1; *Catalogue.* Ray, J. 1674.1

Buckingham: Clark-Kennedy, A. 1868.1

Cambridge: Vallé-Pope, E. 1904.1

Chester: (*Cheshire*) Moore, T. J. 1866.1; Leigh, C. Pre-Linn. 1700.1 — *Rostherne mere.* Coward, T. A. 1912.1; Add. 1914.1; Johnstone, J. 1910.1; Tattersall, W. M., & Coward, T. A. 1914.1

Cornwall: *General treatises.* Borlase, W. 1758.1; Cornish, T. 1878.4; Couch, J. 1838.1; Courtenay, J. S. 1845.1 — *Fresh-water fauna.* Clark, James. 1907.1; Clogg, S. 1866.1; Peach, C. W. 1847.1; Bullmore, W. K. Add. 1867.1 — *Marine fauna.* Allen, E. J. 1897.1; Boase, H. 1833.1; Boulenger, G. A. 1905.7; Bullmore, W. K. 1863.1; Clark, James 1907.1; Clogg, S. 1871.1–1881.1; ★Cornish, T.

1863.1–1891.2; ★Couch, J. 1822.1–1867.2; Couch, R. Q. 1848.1, 1851.1, 1859.1, 2, 1864.1, 4; Cunningham, J. T. 1891.1; Day, F. 1880.13, 1881.8, 9, 1883.7, 1885.6; Drew, J. 1872.1; Dunn, M. 1880.1, 1884.1; Dunn, M., & Holt, E. W. 1897.1; Gatcombe, J. 1872.1, 1873.1, Add. 1885.1; Günther, A. 1860.2, 3, 1892.1; Newton, F. 1870.1; Pickard-Cambridge, F. 1903.1, 2; Worth, R. H. 1897.1 — *Isles of Scilly.* Anon. 107, 236.

Cumberland: Davy, J. 1857.1, 1859.1; Regan, C. T. 1906.14 — *General treatise.* MacPherson, H. A. 1892.1

Devon: *Handbook.* Tugwell, G. 1857.1 — *Fresh-water fauna.* D., H. V. 1830.1; Hearder, W. 1904.1; Matthew, G. F. 1875.1; Scott, W. R. 1865.1, 1868.1 — *Marine fauna, chiefly around Plymouth.* Allen, E. J., & Todd, R. A. 1900.1, 1902.1; Bowles, E. A. 1895.1; Cummings, B. F. 1907.1; Cunningham, J. T. 1892.5; D'Urban, W. S. 1879.1, 2, 1880.1; Garstang, W. 1900.7; Garstang, W., & Byrne, L. W. 1900.1; Gatcombe, J. 1871.1–1882.1, Add. 1885.2; Heape, W. 1887.2; Holt, E. W. 1897.8; Montagu, G. 1816.1; Pengelly, W. 1879.1, 1891.1; Reading, J. J. 1864.1; Stead, F. B. 1897.3, 1898.1; Deere, H. V. Add. 1833.1; Holdsworth, R. Add. 1831.1

Dorset: *Chiefly marine fauna.* Beckford, F. J. 1897.1; Bell, A. S. 1870.1, 2, 3; Colson, J. 1879.1; Gray, J. E. 1873.1; Parlby, — 1849.1; Penney, W. 1879.1; Pickard-Cambridge, F. 1904.1; Thompson, W. 1850.1–1853.1; Coker, N. Pre-Linn. 1732.1

Durham: *Catalogues.* Howse, R. 1890.1, 1894.1; Wallis, J. 1769.1 — *Various papers, chiefly marine fauna.* Brady, G. S. 1872.1; Crooks, St. J. 1860.1; Embleton, D. 1889.1; Hogg, J. 1855.3 (*R. Tees*), 1860.1, 1866.1, 2; Howse, R. 1900.1; Jacob, J. 1849.1; Meek, A. 1904.2, 5; Tristram, H. B. 1866.1, 1867.1; Whitfield, E. 1849.1; Wright, J. 1877.1

Essex: *General treatises.* Laver, H. 1898.1–1903.1; Dale, S. Pre-Linn. 1730.1 — *Marine fauna.* Fitch, E. A. 1897.1; Lindsey, W. H. 1851.1; Murie, J. 1906.2; Parsons, C. 1862.1; Wheatland, R. H. 1852.1; Anon. 394; *Lea R.* Davies, M. Add. 1900.1

Gloucester: *General treatise.* Witchell, C. A., & Strugnell, W. B. 1892.1 — *Severn R.* Day, F. 1890.2; Sweetapple, E. 1867.1–1869.2; Anon. 642 — *Bristol district.* Charbonnier, H. J. 1888.1; Charbonnier & Morgan, C. L. 1898.1 — *Bristol Channel.* (*Marine*) Ferguson, J. 1763.1; Neale, J. J. Add. 1891.1

Hants: (*Hampshire*), including *Isle of Wight.* — *Fresh-water fauna.* Boulenger, G. A. 1900.10; Corbin, G. B. 1907.1 (*Avon R.*); More, A. G. 1860.1; Wadham, P. 1909.1 — *Marine fauna.* Guyon, G. 1865.1; Hadfield, H. 1875.1; Penney, W. 1850.1 — *Selborne: natural history and antiquities.* White, G. 1789.1

Fauna — *Cont'd.*

Hereford: Lingwood, R. M. 1840.1

Hertford: Boulenger, G. A. 1902.16; Chearney, R. 1875.1 (*Lea R.*); Littleboy, J. E. 1880.1; *Lea R.* Saunders, J. 1903.1

Huntingdon: Saville, S. P. 1860.1

Kent: *Marine fauna.* Boys, W. 1786.1; Briggs, J. J. 1852.1; Day, F. 1879.4, 1880.6; Murie, J. 1905.1, 1906.1; Yarrell, W. 1843.1

Lancaster: (*Lancashire*) *Marine fauna, chiefly Liverpool Bay.* Herdman, W. A. 1886.1, Add. 1896.1; Johnstone, J. 1910.1; MacPherson, H. A. 1892.1; Leigh, C. Pre-Linn. 1700.1

Leicester: Browne, A. M. 1887.1, 1889.2

Lincoln: Boulenger, G. A. 1900.1; Brodgen, T. J. 1899.1 (*Catalogue*); Cole, F. J. 1913.1; Day, F. 1877.2; *Bottesford parish.* Peacock, M. 1900.1

Man, Isle of: Herdman, W. A. 1893.1; Jenkins, J. T. 1900.1, 2; Kermode, P. M. 1882.1–1900.1

Norfolk: *Lists.* Lowe, J. 1874.1, 1901.1; Patterson, A. H. 1909.1; Southwell, T. 1904.1 — *Marine fauna, chiefly of Great Yarmouth.* Browne, T. 1835.1, 1902.1; Emerson, P. H. 1896.1; Gunn, T. E. 1865.1, 1866.3, 1869.1, 1879.2; Gurney, J. H. 1861.1, 1875.2, 1879.1; John, C., & Paget, J. 1834.1; Lubbock, R. 1845.1, Add. 1879.1; Patterson, A. H. 1891.1–1914.3, Add. 1906.1; Southwell, T. 1879.1–1902.1; Tregellas, -. 1875.1; Yarrell, W. 1843.1; *Yare River.* Anon. 111

Northampton: Boulenger, G. A. 1902.17; Günther, A. 1889.5; Leach, E. F., & Wright, C. E. 1899.1; *Early natural history.* Morton, J. Pre-Linn. 1712.1

Northumberland: *Catalogues.* Howse, R. 1890.1, 1894.1; Wallis, J. 1769.1 — *Fresh-water: Tyne and Tweed Rivers.* Atkinson, G. C. 1867.1; Jardine, W. 1834.1; Meek, A. 1906.1; Oliver, S. 1835.1; Tate, G. 1868.1; Thompson, P. R. 1908.1 — *Marine fauna.* Bolam, G. 1891.1; Cornish, T. 1880.3; Hancock, A., & Embleton, D. 1846.1; Hogg, J. 1870.1; Howse, R. 1884.1, 2, 1894.2; Meek, A. 1903.2, 1904.1, 5; P., W. 1877.1; W., J. 1877.2

Nottingham: *Trent River.* Briggs, J. J. 1843.1; Carr, J. W. 1898.1, 2

Oxford: *Early nat. hist.* Plot, R. Pre-Linn. 1677.1

Salop: (*Shropshire*) Forrest, H. E. 1899.1

Somerset: *Chiefly littoral fauna.* Baker, W. 1850.1, Add. 1849.1; Blathwayt, F. L. 1906.1; Day, F. 1879.2; Higgins, E. T. 1861.1; Compton, T. Add. 1892.1

Stafford: Hamel, E. 1870.1; Day, F. Add. 1897.1; *Early natural history.* Plot, R. Pre-Linn. 1686.1

Suffolk: *Fresh-water at Thetford.* Clarke, W. G. 1897.1, 1907.1 — *Marine*

fauna. Christy, R. M. 1899.1; Clarke, W. B. 1837.1; Gunn, T. E. 1866.3, 1879.1; Patterson, A. H. 1909.3; Southwell, T. 1875.1, 1879.2; *List.* Yarrell, W., & Clarke, W. B. 1837.1

Surrey: Boulenger, G. A. 1902.18

Sussex: *Chiefly marine fauna of Brighton.* Belt, A. 1912.1; Bowerbank, J. S. 1873.1–1874.2; Carrington, J. T. 1880.1; Day, F. 1880.4; Distant, W. L. 1904.1; Jeffery, W. 1868.2; Kidd, W. 1843.1; Roper, F. C. 1869.1, 1879.1, 2 (*Eastbourne*); Toms, H. S. 1901.1; *Rye.* Theobald, F. V. Add. 1885.1

Thames River: Binnell, R. 1785.1; Clark-Kennedy, A. 1867.1; Russell, A. J. 1879.1; Anon. 157

Warwick: *Sutton Coldfield Park.* Elliott, J. S. 1896.1; *Birmingham.* Tye, G. S. Add. 1886.1

Westmoreland: Braithwaite, G. F. 1884.1; Davy, J. 1857.1, 1859.1; MacPherson, H. A. 1892.1

Wilts: *Marlborough.* Meyrick, E. 1897.1

Worcester: Willis-Bund, J. W. 1901.1; *Avon River.* Hastings, C. Add. 1834.1; Perrott, C. L. Add. 1834.1

York: *Handbooks.* Clarke, W. E., & Roebuck, W. D. 1881.1; Denny, A. 1910.1 — *Fresh-water fauna.* Clarke, W. E. 1884.1; Meynell, T. 1844.1; Miall, L. C. 1890.1; Pascoe, F. P. 1883.1 (*Ouse R.*); Waite, E. R. 1891.1 (*Ainsty R.*); Denny, H. Add. 1840.1 — *Marine fauna, chiefly of Scarborough and Whitby.* Briggs, J. J. 1854.1; Clarke, W. E. 1882.1, 1893.1; Clarke, W. G. 1898.1, 2; Clarke, W. J. 1896.1–1912.2; Cordeaux, J. 1879.1; Harting, J. E. 1880.1; Leckenby, J. 1858.1; Nelson, T. H., & Clarke, W. E. 1893.1; Stephenson, T. 1894.1; Strickland, A. 1840.1; Anon. 152

Hebrides Islands

General treatise. Smith, W. A. 1888.1, 1892.1; *North Uist.* Günther, A. 1882.1; McIntosh, W. C. Add. 1866.1

Ireland

Catalogues, general treatises, etc. Browne, P. 1774.1; Day, F. 1880.2; Holt, E. W., & Calderwood, W. L. 1895.1; Thompson, W. 1849.1

Misc. and Gen.: Chiefly marine. Andrews, W. 1849.1–1871.1; Bellingham, O. 1840.1; Forrest, H. E. 1908.1; Günther, A. 1861.2, 1862.1, 1889.3; Harting, J. E. 1883.1; Holt, E. W. 1892.4–1911.1; Holt, E. W., & Byrne, L. W. 1903.1–1913.1; Hunter, J. 1774.2; M'Coy, F. 1841.1, 1847.1; Ogilby, J. D. 1885.4; Regan, C. T. 1909.3; Scharff, R. F. 1890.1–1915.2; Thompson, W. 1834.1–1843.1 — *Barrow and Suir Rivers.* Barrett-Hamilton, G. 1899.1 — *Early references in Pre-Linn. section.* Giraldus Cambrensis 1587.1; Smith, C. 1744.1–1756.1

Connaught: *Clare I.* Farran, G. P. 1912.1 — *Galway (Co.)* Francis, F. 1878.3 — *Killala Bay.* Warren, R. 1900.1, 2

Irish Sea: Andrews, W. 1858.1, 1860.2, 1869.1; Ball, Robert, 1855.1; Bassett, H. 1913.1; Herdman, W. A., & Dawson, R. A. 1902.1; Herdman & Riddell, W. 1913.1; Herdman, Scott, A., & Lewis, H. M. 1913.1; Johnstone, J. 1912.3; Kinahan, J. R. 1859.2; Moore, T. J. 1866.1; More, A. G. 1878.1, 1882.1; Scott, A. 1905.1-1907.1; *Review of Herdman & Dawson*. Smith, H. M. 1902.3

Leinster: *Dublin (Co.); General treatises.* Carpenter, G. H., & others 1908.1; Rutty, J. 1772.1 — *Other papers.* Blake-Knox, H. 1866.1; *Dodder R., list.* Kinahan, J. R. 1854.2; *Lambay I.* Scharff, R. F. 1907.2

Munster: *Kerry (Co.)* Barrett-Hamilton, G. 1892.1; *Valencia Harbor.* Cunningham, J. T. 1900.1; *Clare (Co.)* Kinahan, J. R. 1859.1; *Killarney Lakes.* Regan, C. T. 1912.24; *Cork (Co.)* Scharff, R. F. 1910.2, *Valencia I.* 1915.1; *Exploration of caves of Co. Clare.* Scharff, Ussher, Cole & others. 1906.1

Ulster: *Rathlin I.* Bewley, B. F. 1864.1; *Down (Co.)* Harvie-Brown, J. A. 1901.3, 1902.2; *Donegal (Co.)* Scharff, R. F. 1905.1, 1906.1; *Lough Neagh.* Thompson, W. 1835.1, 1837.1, 2, 1852.1 — *Antrim (Co.)* Dubourdieu, J. 1812.1; M'Skimin, — 1811.1; Ogilby, J. D. 1876.1; *Belfast Lough. General treatise.* Patterson, R. L. 1880.1, 2

Orkney Islands

Chiefly marine fauna. Barclay, J. 1808.1; Clarke, W. E. 1900.2; Cursiter, J. W. 1896.1; Hoffmann, F. 1818.1; Low, G. 1813.1; Buckley, T. E., & Harvie-Brown, J. A. Add. 1891.1 — *Catalogue.* Baikie, W. B. Add. 1853.1 — *Early ref.* Wallace, J. Pre-Linn. 1693.1

Scotland

Sport: salmon fishing, etc. Calderwood, W. L. 1909.2; Hector, A. 1861.1; Hicks, J. 1855.1; Lauder, T. D. 1874.1; Muirhead, G. 1903.1; Oliver, S. 1835.1; Grimble, A. Add. 1913.1

Marine fauna of "Coast of Scotland," localities not mentioned. Anderson, W. 1894.1; Bowman, A. 1913.1; Brook, G., & Scott, T. 1885.1; Ewart, J. C. 1891.1; Günther, A. 1888.2; Harvie-Brown, J. A. 1883.1; Herdman, W. A., & Riddell, W. 1913.1; Rennie, J. 1907.1; Smith, W. A. 1888.2; — *East coast, Wick to Firth of Forth: general treatise.* Sim, G. 1903.1

Evidence for a Scottish-Norwegian land bridge. Stejneger, L. 1909.1

Early references to Scottish fauna. Sibbald, R. Pre-Linn. 1684.1, 1710.1

Aberdeen: *Chiefly marine fauna.* Arbuthnot, J. 1815.1; Day, F. 1885.9, 11; Dyce, R., & Sim, G. 1878.1 (*Catalogue*); Howden, J. C. 1887.1; MacGillivray, J. 1842.1; Meek, A. 1893.1; Sim, G. 1883.3, 1885.1; Young, M., & Eagle Clarke, W. 1892.1

Argyll: *General treatise.* Harvie-Brown, J. A., & Buckley, T. E. 1892.1; *Loch*

Fyne. Robertson, D. 1888.1; Scott, T. 1897.1; Smith, W. A. 1892.1

Banff: *Marine fauna.* Edwards, T. 1860.1-1882.1; Lemmon, J. 1905.1; Smiles, S. 1877.1

Berwick: *Littoral fauna.* Hardy, J. 1876.1; *Tweed R.* Jardine, W. 1834.1; *List.* Johnston, G. 1834.1, 2

Caithness: *Marine.* Peach, C. W. 1859.2

Clyde, Firth of: Bryce, J. 1859.1 (*Arran I.*); Campbell, J. M. 1880.1, 1881.1; Elmhirst, R. 1913.1 (*Little Cumbrae I.*); Nicoll, W. 1910.1; Patience, A. 1908.1; Scott, T. 1900.1; Add. 1901.1; Sinclair, J. 1793.1

Dumfries: *Fresh-water fauna.* Jardine, W. 1831.1; Martin, J. W. 1907.1; Maxwell, H. E. 1892.1; Regan, C. T. 1906.14; Service, R. 1892.1, 1902.1, 1904.1 — *For marine fauna see Solway Firth below.*

Edinburgh: *List.* Neill, P. 1808.1

Fife: *Marine fauna of St. Andrews Bay.* F., A. 1880.1; Holt, E. W. 1890.2, 1891.1; McIntosh, W. C. 1874.1, 1888.4, 1890.5, Add. 1875.1, Add. 1889.2, Add. 1893.1; Walker, R. 1862.1, 1874.2

Forfar: *Montrose.* Richardson, J. 1860.1

Forth, Firth of: *General treatise.* ★Parnell, R. 1831.1 — *Other papers.* Brown, Robert. 1860.1; Clarke, W. E. 1895.1, 1900.1; Evans, W. 1905.1, 1907.1, Add. 1897.1, 1898.1; Leach, W. E. 1818.1; Logan, R. F. 1858.1; Neill, P. 1808.1 (*List*); Parnell, R. 1832.4, 1835.1, 1837.2, 1839.1-4; Peach, C. W. 1880.1, 2; Pearcey, F. G. 1902.1; Reid, J. 1849.1; Smith, J. Alex. 1852.1, 1867.5; Stirton, J. 1900.1; Young, W. S. 1863.1, 2; Sibbald, R. Pre-Linn. 1710.1

Haddington: *Marine fauna.* Evans, W. 1908.1, 1909.1; Gray, R. 1849.1

Inverness: *Marine fauna.* Harvie-Brown, J. A. 1902.1; Traquair, R. H. 1898.3

Islay: *Loch-na-Maorachan.* Thomson, J. 1873.1; Traquair, R. H. 1872.1

Kincardine: *Marine fauna.* Sim, G. 1896.1

Kirkcudbright: *Fresh-water fauna.* Maxwell, H. E. 1892.1; Service, R. 1892.1, 1902.1, 1904.1

Lanark: *Clyde River.* Grevé, C. H. 1897.1; Hoyle, W. E. 1889.1; *Glasgow.* Scouler, J. Add. 1833.1

Moray Firth: Harvie-Brown, J. A., & Buckley, T. E. 1887.1, 1895.1; Hoy, J. 1815.1; McIntosh, W. C. 1896.1

Perth: *Tay River.* Calderwood, W. L. 1904.3, 4, 1906.1; Knox, R. 1830.1; Russell, A. 1864.1; Smith, J. Alex. 1878.1

Ross and Cromarty: *Loch Bad-a-Luacradh.* Plant, J. 1878.1-1879.2

Skye, Isle of: Günther, A. 1889.5

Fauna — *Cont'd.*

Solway Firth: MacPherson, H. A. 1896.1; Service, R. 1896.1, 1906.1, 2, 1907.1

Stirling: *Loch Lomond.* Biedie, G. 1896.1; Brown, Alfred W. 1891.1, 1896.1; Parnell, R. 1838.2

Sutherland: *Marine.* Beveridge, A. 1892.1; *Fresh-water.* Jardine, W. 1834.3

Wigtown: *Loch Ryan.* Barty, T. 1884.1; *Galloway.* Beechey, F. W. 1842.1; Clark-Kennedy, A. 1875.1–1879.1

Shetland Islands

Marine fauna. Clarke, J. B. 1905.1; Le Danois, E. 1913.3, 1914.1; Low, G. 1813.1; Neill, P. 1826.1; Pearcey, F. G. 1884.1; Saxby, H. L. 1866.1; Saxby, T. E. 1905.1; Traquair, R. H. 1896.1; Tulloch, J. S. 1905.1; — *Catalogue.* Baikie, W. B. Add. 1853.1

Wales

Uisk River. Baker, W. 1847.1; Bladon, J. 1846.1 — *Other localities.* Barrington, D. 1767.1; Davis, J. F. 1841.1 (*Tenby*); Forrest, H. E. 1908.1; Grimble, A. 1904.1; Günther, A. 1861.2, 1862.1; — *Cardigan Bay.* Walton, C. L. 1913.1 — *Carmarthen (Co.)* Williams, D. 1863.1 — *Swansea Bay.* Dillwyn, L. W. Add. 1831.1

BULGARIA

For fauna of Black Sea, see above under Black Sea. See also Chichoff, G. 1912.1

CORSICA

Marine fauna, chiefly. Caraffa, T. 1902.1; Roule, L. 1900.2, 1902.2 *List*, 1902.4 — *Fresh-water fishes.* Roule, L. 1900.1

DENMARK

General treatises: *Catalogues, lists, etc.* Feddersen, A. F. 1879.1; Henriksen, H. P. 1904.1; Kroyer, H. N. 1838.1, 1853.1; Müller, O. F. 1776.1, 1788.1; Otterstrøm, C. V. 1912.1; Schjødt, J. 1878.1; Winther, G. P. 1879.1, 1882.1 — *General geographical treatise.* Pontoppidan, E. L. 1766.1, Add. 1763.1

Bibliographies of zoological literature. Dahl, S. 1910.1; Gosch, C. C. 1870.1, 1873.1, 1875.1

Kitchen middens of the Stone Age. Petersen, C. G., Winge & Winge 1888.1; Winge, A. H. 1903.1

Marine fauna: *including Cattegat and Skager Rack.* Ascanius, P. 1772.1; Aurivillius, C. W. 1898.1; Baden, H. T. 1903.1; Böving, P. 1910.1; Bolling, — 1868.1; Dobrée, N. F. 1863.1; Faber, F. 1828.4; Fiedler, H. V. 1866.1, 1870.1, 1873.1; Gundel, E. V. 1888.1; Hansen, H. J. 1883.1; Hjort, J., & Gran, H. H. 1900.1; Jensen, A. S. 1897.1, 1901.2, 1905.3; Johansen, A. C. 1901.1; Johansen, A. C. & Neergaard-Møller, E. 1912.1–1913.1; Kroyer, H. N. 1861.1, 1868.1; Lönnberg, A. J. 1898.4, 1899.2, 1902.9; Lütken, C. F. 1865.1, 1873.2; Malm, A.

W. 1874.3; Otterstrøm, A. N. 1906.2; ★Petersen, C. G. 1884.1–1903.2; Reinhardt, J. C. 1825.1, 1830.1, 1831.1, 2, 1834.2, 3; Steenstrup, J. J., & Lütken, C. F. 1862.1; Bang, H. Add. 1823.1; Pontoppidan, E. L. Add. 1765.1; Trybom, F. Add. 1903.1 — *See also Baltic Sea and North Sea.*

Fresh-water fauna: Feddersen, A. F. 1879.1, 1880.1, 2

FAROE ISLANDS

Marine fauna, chiefly. Collett, R. 1904.1; Gaimard, J. P. 1842.1; Günther, A. 1882.2; Holt, E. W. 1893.2, 1898.5; Landts, — 1800.1; Le Danois, E. 1913.3, 1914.1 — *Skaaren Is.* Levander, K. M. 1900.4 — *Early reference.* Debes, L. J. Pre-Linn. 1673.1

FRANCE

General treatises: Acloque, A. 1900.1; Audouin, J. V., & Edwards, H. M. 1832.1; Beaumont, E. H. 1879.1; Blainville, H. M. 1820.1; ★Blanchard, C. E. 1866.1, 1880.1; Clément, A. L., & Troncet, L. J. 1897.1; Crespon, J. 1844.1; Gervais, F. L. 1848.2, 1859.2; ★Gervais, H. F., & Boulart, R. 1876.1; ★Moreau, E. 1881.1, 1891.2, 1892.1; Raveret-Wattel, C. 1900.1, Add. 1909.1; Rolland, E. 1881.1; Vachal, J. 1899.1; Vallot, J. N. 1837.1, 1850.1; Holland, E. Add. 1877.1

Miscellaneous and general, definite localities not given. Bellotti, C. 1891.1, 1892.1; Blainville, H. M. 1820.1; Canu, E. 1893.1; Coste, J. J. 1855.2, 1861.1, 1866.2; De la Pylaie, — 1835.1; Desvaux, A. N. 1851.1; Künstler, J. 1908.2; Le Danois, E. 1909.2, 1913.5; Le Grand d'Aussy, P. 1782.1; Pellegrin, J. 1912.16; Anon. 466. — *Bibliography.* Herissant, S. A. 1771.1 — *Vernacular names.* Theuratte, A. D. 1898.1

Allier: Olivier, E. 1897.1, 1898.1, 1913.1; *Montluçon. General treatise.* Villatte des Prunes, R. 1897.1

Alpes-Maritimes: *Marine fauna of Nice.* Deakin, R. 1866.1; Fage, L. 1910.1; Jaquet, M. 1907.1; Perrot, L. 1819.1; Piraud, V. 1911.1, 1912.1; ★Risso, A. 1810.1, 1820.1, 1824.1, 1826.1, 1840.2; Sarato, — 1890.1

Ariège: Marcailhou-d'Ayméric, H. 1899.1, 2

Aude: *Castelnaudary.* Depéret, C. 1885.1

Auvergne: Bruyant, C. 1893.1, 1910.2; Bruyant, C., & Eusebio, J. 1904.1; Lamie, J. 1903.1; Delarbre, A. Add. 1798.1

Aveyron: *Rouergue.* La Blanchère, P. 1872.5, 1873.2

Basses-Pyrénées: *Bayonne.* Darracq, U. 1860.1

Belfort: (*Territory*). Roesch, C. 1901.1

Biscay, Bay of: *including Gulf of Gascony.* Bryne, L. W. 1907.1; Holt, E. W., & Byrne, L. W. 1907.1; Koehler, R. 1896.1; Künstler, J. 1908.4; Le Danois, E. 1914.1; Pellegrin, J., & Loppé, E. 1914.1; Vaillant, L. L. 1901.1

Bouches-du-Rhône: *Marine fauna of Marseilles.* Briot, A., & Gaver, F. 1905.1; Brännich, M. T. 1768.1; Gouriet, E. 1890.1, 1893.1, 1894.4, -9; Marion, A. F. 1883.1, 1887.1, 1894.10; Raymond, - 1777.1; Sicard, A. 1865.1; Vayssière, A. 1908.1, 2; Rondelet, G. Pre-Linn. 1555.1

Bourbonnais: Berthoumieu, V. 1899.1

Brittany: Boulenger, G. A. 1899.10; Bureau, L. 1901.1; Guérin-Ganivet, - 1912.1

Calvados: Brasil, L., & Gadeau de Kerville, H. 1905.1; Gadeau de Kerville, H. 1898.1

Charente: Lemarié, E. 1866.1

Charente-Inférieure: Beltrémieux, E. 1864.1; Lemarié, E. 1866.1

Côte-d'Or: Vallot, J. N. 1836.1

Dauphiné: Cépède, C. 1905.1; Keilhack, F. L. 1907.1; Léger, L. 1910.4

Deux-Sèvres: Gelin, H. 1911.1; Lemarié, E. 1866.1

Doubs: *General treatise.* Olivier, E. 1883.1

Finistère: *Marine fauna.* Borcéa, J. 1904.4; Boulenger, E. G. 1911.1; Fabre-Domergue, P., & Biérix, E. 1896.1, 2; Gervais, F. L., & Gervais, H. F. 1876.1, 1877.1; Le Danois, E. 1910.1; Vaillant, L. L. 1895.4; Anon. 155; Delage, Y. Add. 1914.1

Garonne River: *including Gironde R.* Lafont, A. 1868.1; Laporte, E. 1853.1-1856.1, Add. 1853.1; Mourgue, M. 1901.2, 1909.1

Gironde: *Marine fauna of Arcachon.* Bert, P. 1866.2; Durègne, E. 1887.1, 1889.1 — *For Gironde R., see Garonne River.*

Hautes-Alpes: Blanchard, R., & Richard, J. 1897.1

Haute-Garonne: Belloc, E. 1911.1; Lahille, F. 1888.1 (*Toulouse*); Noulet, J. B. 1891.1 (*List.*); Roule, L. 1902.5, 1903.3, 1904.1, 1905.1

Haute-Vienne: Fournier, - 1860.1

Hérault: *Marine fauna of Cette.* Calvet, L. 1905.1; Doumet-Adanson, P. 1860.1 — *Etang de Thau.* Gouriet, E. 1886.1, 1896.1, -3

Indre: Martin, R., & Rollinat, R. 1892.1, 1894.1

Isère: Charvet, P. A. 1846.1; Eynard, L. 1912.1; Léger, L. 1905.1; Perrier, L. 1899.1; Piraud, V. 1909.1

Jura: *General treatise.* Ogérien, - 1876.1

Landes: *Adour River.* Dubalen, - 1878.1; Roule, L., & Caradaillac de, S. P. 1903.1; Saint-Paul, G. D. 1902.1

Languedoc: Doumet-Adanson, P. 1869.1, 1872.1, Anon. 756.

Loire: *Catalogue.* Fourny-Dulys, 1862.1, Add. 1864.1

Loire River: Bureau, L. 1891.1, 1895.1; Marchand, E. 1897.1, 1901.1; Paratre, R. 1893.1; Pellegrin, J. 1900.2

Loire-Inférieure: Bureau, L. 1890.1-1905.1; Desvaux, A. N. 1851.1, Add. 1843.1

Maine-et-Loire: *Anjou R.* Soland, A. 1869.1

Manche: *Marine fauna, chiefly.* Besnou, L. 1861.1; Gadeau de Kerville, H. 1894.2, 1898.1; Jouan, H. 1860.1, 2, 1874.1, 1884.1, 1895.1, 1900.1; Jourdain, S. 1879.1, 2; ★Le Danois, E. 1913.2, 4; Sivard de Beaulieu, G. 1851.1, 1852.1, 1855.1; *Tatihou I.* Wuitner, E. 1912.1, 1913.1

Mayenne: *List.* Lambert, E. A. 1894.1

Meurthe-et-Moselle: *Chiefly Moselle River.* Drouin de Bouville, R. 1902.1; Fournel, D. H. 1827.1; Géhin, J. J. 1868.1; Hollandre, J. J. 1826.1, 1838.1; Ausonius, D. M. Pre-Linn. 1580.1

Nord: Godon, J. 1905.1, 1908.1; Norquet, A. 1872.1

Normandy: *General treatise.* Gadeau de Kerville, H. 1896.1

Oise: Maillard, F. Add. 1852.1

Orne: Letacq, A. L. 1897.1, 1900.1, 1907.1

Pas-de-Calais: *Chiefly marine fauna of Boulogne.* Cligny, A. 1906.1, 1912.5; Giard, A. 1888.1, 1903.4, 1904.1; Gilson, G. 1908.2; Hallez, P. 1905.1; *Catalogue.* Sauvage, H. E. 1888.1, 6

Provence: Reguis, J. F. 1877.1, 1882.1; Marion, A. F. Add. 1886.1

Pyrénées-Orientales: Companyo, L. 1863.1; Fage, L. 1907.1; Marcailhou-d'Ayméric, H. 1899.1, 2; *Perpignan, River Tet.* Steindachner, F. 1866.3

Rhône River: Fournet, J. J. 1853.1

Saône-et-Loire: Gensoul, J. 1908.1 (*Monograph*); Grognot, - 1866.1; Quincy, C. 1907.1; Anon. 329, 452

Sarthe: Anjubault, P. A. 1855.1; Gentil, A. 1884.1

Savoie: Blanchard, R. 1896.1; Cépède, C. 1905.1; *Lac du Bourget.* Fatio, V. 1888.3

Seine: (*Dept.*) *Paris-Market fishes.* Pellegrin, J. 1912.1

Seine-Inférieure: *Dieppe.* Coulon, L. 1905.1; *Saint-Vaast, (Catalogue)* Malard, A. E. 1890.1

Seine River: Gadeau de Kerville, H. 1886.1; Mesaize, -, & Noel, - 1799.1

Somme: Brandicourt, V. 1891.1, 1897.1; *Abbeville. Catalogue.* Baillon, L. 1833.1; *Amiens.* Dubois, M. 1879.1; Duchaussoy, H. 1891.1

Tarn: Caraven-Cachin, A. 1895.1, 1903.1; Thomas, P. 1881.2

Var: Doublier, - Add. 1853.1

Vaucluse: Reguis, J. F. 1896.1, 1898.1

Fauna — *Cont'd.*

Vendée: Gelin, H. 1911.1; Lemarié, E. 1866.1

Vienne: Lemarié, E. 1866.1

Yonne: Bert, P. 1879.1, Add. 1864.1; Moreau, E. 1898.1

GERMANY

Bibliography. Buchenau, F. 1897.1; Müller, J. (librarian) 1883.1

Distribution. Agassiz, J. L. 1862.1; Eckstein, K. 1905.1; Schulze, E. 1890.1; Wittmack, M. C. 1875.3

Miscellaneous and general. Birkholz, J. C. 1770.1; Raschke, W. 1907.1, 1909.1; Wimmer, J. 1903.1, 1905.1; Zacharias, E. O. 1891.1

Early natural history writings in Pre-Linn. section. Baldner, L. 1666.1; Hildgarde Pingua 1533.1; Mareschalcus, N. 1517.1 — *Moselle R.* Ausonius, D. M. 1580.1; Figulus, C. 1540.1

Marine fauna

Popular general treatise. Henking, H. 1899.1

East Coast or Baltic Sea fauna: Etzel, A. 1859.1 — *Schleswig-Holstein.* Brüssow, — 1879.1; *Kiel.* Brandt, K. 1897.1; ★Meyer, H. A., & Möbius, K. 1865.1 — *Pomerania, Stettiner Haff.* Brandt, K. 1896.1; *Leba See.* Holland, T. 1879.1; *Rügen I.* Müller, G. W. 1909.1; Münster, J. A. 1871.1, 2, 1876.1 — *East Prussia, Frische Haff.* Brauer, A. 1905.1; *Kurisches Haff.* Seligo, A. 1894.2

See also Baltic Sea, above.

West Coast or North Sea fauna: *Prussia, Hannover, East Friesland.* Ehlers, E. H. 1886.1 — *East Friesian Is.* Schneider, O. 1898.1 — *Helgoland.* Ehlers, E. H. 1878.1; Heincke, F. 1894.1, 1897.1; Hoffmann, F. 1829.1 — *Schleswig-Holstein, Büsum.* Pansch, A. 1868.1 — See also North Sea, below.

Fresh-water fauna

General treatises: (*Technical*) Günther, A. 1855.1; Matschie, P., Reichenow, A., Tornier, G., & Pappenheim, P. 1909.1; Pappenheim, P. 1909.1; Schulze, E. 1889.1–1892.1 — See also "Die Süßwasserfische von Mitteleuropa," at beginning of this section of Fauna, Europe.

Popular general treatises. (*Text in German.*) Alvenstod, S. M. 1837.1; Baldner, L. 1903.1; Bloch, M. E. 1780.1–1785.2; Fechner, H., & Paeske, C. 1909.1; Floerike, K. E. 1913.1; Grimm, E. 1906.1; Hoffbauer, C. 1912.2; Nitsche, H. 1898.1, 1909.1; Reichenbach, H. G. 1842.1; Seligo, A. 1891.1; Walter, E. 1913.1, 2; Walther, F. L. 1820.1; Weber, J. C., & Kranz, C. A. 1870.1

Various rivers and localities: *Bremen, (Free City.)* Borcharding, F. 1890.1; Heincken, P. 1837.1 — *Elbe R.* Dahl, F. T. 1889.1, 1893.1; Ehrenbaum, E. 1896.1; Lohmeyer, C. F. 1907.1 — *Hamburg, (Free City.)* General treatise. Kraepelin, K. 1901.1 — *Main R.* Buxbaum, L. 1892.1–

1904.1; *List.* Leiblein, — 1853.1 — *Rhine R.* Bergner, J. 1906.1; F., H. 1897.1; Lauterborn, R. 1904.1–1906.1; Leuthner, F. J. 1877.1 (*Gen. treat.*); Leydig, F. 1882.1; Sander, H. 1781.1 — *Weser R.* Häpke, L. 1876.1–1913.1; Lohmeyer, C. F. 1907.1

Alsace-Lorraine: (*Imp. Terr.*), *Alsace.* Martin, D. 1897.1; Reiber, F. 1887.1; Wackenheim, M., & Engmann, P. 1911.1 — *Lorraine.* Barbiche, — 1887.1 (*Nied R.*); Buc'Hoz, P. J. 1771.1; Godron, D. A. 1862.1; Schatz, G. 1908.1; Anon. 337

Baden: (*Grand Duchy*) Schlesinger, F. W. 1900.2; Anon. 218

Bavaria: (*Kingdom*) *General treatises.* Fraisse, P. H. 1880.1; Reider, J. E., & Hahn, C. W. 1834.1; Rush, N. 1878.1; Schrank, F. Add. 1798.1 — *Various localities.* Agassiz, J. L. 1828.1; Büchele, J. 1860.1 (*Iller R.*); Faist, A. J. 1871.1; Fürnrohr, A. E. 1847.1; Grandauer, A. 1853.1; Hofer, B. 1908.2 (*Ammersee*); Jäckel, A. J. 1864.1; Koch, C. L. 1840.1; Küster, H. C. 1840.1; Lori, F. A. 1871.1; Rosenhauer, W. G. 1858.1; Schaeffer, J. C. 1761.1; Spannagel, — 1859.1; Walzl, J. 1872.1; Weber, J. C. 1851.1; Wiedemann, A. 1885.1; Wispauer, J. 1880.1 (*Königssee*); Zenk, F. 1889.1 — *Early references.* Meichelbeck Pre-Linn. 1753.1; Rumpler, A. Pre-Linn. 1500.1

Brunswick: (*Duchy*) Kybitz, C. W. 1893.1; Gosky, M. Pre-Linn. 1650.1

Hesse: (*Grand Duchy*), *Mainz.* Nau, B. 1788.1 — *Wetterau, Upper Hesse.* Jäger, K. 1858.1; Fabricius, P. Pre-Linn. 1749.1

Mecklenburg-Schwerin: (*Grand Duchy*) Blanck, A. 1881.1; Boll, E. 1858.1, 1859.1; Jesse, R. 1903.1; Siemsen, A. C. 1794.1

Prussia (Kingdom)

General treatises. Bujack, J. G. 1837.1; Lorck, C. G. 1834.1

Brandenburg: (*Prov.*), *General treatise.* Schulz, J. H. 1845.1 — *Bibliography.* Matzdorff, C. 1900.1; Pappenheim, K. 1902.1 — *Other papers.* Friedel, E. 1869.1, 1880.1; Peters, W. C. 1875.2

East Prussia: (*Prov.*) Bock, F. S. 1784.1; Rathke, M. H. 1846.1

Hannover: (*Prov.*) Borcharding, F. 1887.1 (*Bederkesaer See*); Löns, H. 1905.1–1907.2; Lohmeyer, C. F. 1873.1; Schreiber, C. 1849.1 (*Werra R.*); Anon. 88

Hesse-Nassau: (*Prov.*), *General treatise.* Kirschbaum, C. L. 1863.1 — *Bibliography.* Ackermann, K. 1884.1 — *Various papers.* Borggreve, B. 1897.1; Bruhin, P. T. 1868.1; Metzger, A. 1878.2; Schwaeb, W. 1851.1; Zenk, F. 1889.1

Pomerania: (*Prov.*), "*Pommern.*" Berghaus, A. 1877.1; Boll, E. 1864.1; Kammerer, P. 1901.2; Samter, M. 1912.1 — *Madü-See.* Eckardt, R. 1875.1–1878.3;

Grube, A. E. 1875.1; Samter, M. & Weltner, W. 1905.1

Rhine Province or *Rhenish Prussia* (*Rheinland*), *Duisburg*. Merrem, L. 1789.1; Schaeffer, J. C. 1760.1 — *Koblenz district, Kreuznach*. Geisenheyner, L. 1888.1 — *Laachersee*. Thienemann, A. 1911.3, 1912.5, 1914.1 — *Treves district*. Schaefer, M. 1844.1; Schnur, — 1847.1; Weber, C. O. 1862.1

Saxony: (*Prov.*), *Magdeburg*. Ebeling, C. W. 1871.1,2

Schleswig-Holstein: (*Prov.*), *Neustadt*. Duncker, G. 1896.2, 1904.2 — *Travemünde*. Lenz, H. 1880.1; Milde, C. J. 1873.1 — *Plöner See*. Zacharias, E. O. 1893.2, 1903.1 — *Early refs. in Pre-Linn. section*. Kannegiesser, G. H. 1750.1; Schonevelde, S. A. 1624.1

Silesia: (*Prov.*), *General treatises*. Gloger, C. W. 1833.1; Heinrich, A. 1856.1; Schilling, P. S. 1839.1; Weigel, J. A. 1806.1 — *Various papers*. Boerner, J. C. 1781.1; Endler, F. G., & Scholz, F. P. 1809.1; Grube, A. E. 1867.1, 1870.1; Kaluza, A. 1815.1; Knauth, K. 1890.2 — *Early references*. Henelius, N. Pre-Linn. 1704.1; Schwenckfeld, C. Pre-Linn. 1603.1

Westphalia: (*Prov.*) Landois, H. 1871.1, 1874.1; Meyer, C. F. 1798.1; Reeker, H. 1892.1; Seetzen, U. J. 1794.1, 1795.1; Suffrian, — 1846.1; Thienemann, A. 1911.4, 1912.1,2,4 — *Salt-well fauna*. Schmidt, R. 1913.1; Thienemann, A. 1913.1

West Prussia: (*Prov.*) Bock, F. S. 1784.1; Rathke, M. H. 1846.1; Seligo, A. 1904.2 (*Weitsee*); Treichel, A. 1893.1

Reuss-Gera-Schleiz: (*Princip.*), *Gera*. Burckhardt, C. F. 1860.1

Saxe-Coburg-Gotha: (*Duchy*), *Seeberg*. Zahn, G. Add. 1901.1

Saxony: (*Kingdom*), *Bibliography*. Fiskel, J. 1902.1 — *Various papers*. Leske, N. G. 1774.1; Meyer, A. B., & Helm, F. 1896.1; List. Reibisch, J. 1868.1 — *Early ref.* Lehmann, C. Pre-Linn. 1699.1 — *See also Saxony (Prov.), under Prussia*.

Württemberg: (*Kingdom*), *General treatise*. ★Günther, A. 1853.1 — *Various papers*. Klunzinger, C. B. 1881.1; Koenig-Warthaussen, R. 1896.1; Piesbergen, F. 1886.1; Tscherning, F. A. 1899.1; Veesenmeyer, — 1859.1, 1884.1; Wild, G. 1903.1; Anon. 713. — *Neckar River*. Günther, A. 1853.1, 1857.1; Krauss, F. 1863.1–1865.2

GREECE

General treatises, catalogues, etc. Helde- reich, T. 1878.1; Hoffman, H. A., & Jordan, D. S. 1893.1 — *Bibliography*. Koraes, A. 1809.1 — *Nomenclature*. Bikélas, D. 1878.1 — *Various localities*. Apostolidès, N. C. 1883.1, 1892.1; Bibron, G., & Bory de Saint-Vincent, J. 1833.1; Bory de Saint-Vincent, J. 1832.1; Erhard, (Dr.) 1858.1; Riggio, G. 1894.1; Wilde,

W. R. 1840.1; Bent, T. Add. 1889.1 — *Corfu I.* Martin, M. 1834.1; Sauvage, H. E. 1880.4 — *Aspropotamos River*. Steindachner, F. 1896.1

HOLLAND, see NETHERLANDS

ICELAND

Popular general treatises. Faber, F. 1829.1; Horrebov, N. 1758.1; Mohr, N. 1786.1; Sæmundsson, B. 1909.1 — *Marine fauna, chiefly*. Bleeker, P. 1873.6; Fabricius, O. 1824.1; Holt, E. W. 1893.2; Johansen, A. C. 1903.1; Le Danois, E. 1913.3, 1914.1; Lütken, C. F. 1876.1, 1877.2, 1880.2, 1898.1; Pietschmann, V. 1906.1; Reinhardt, J. C. 1832.1; Sæmundsson, B. 1897.1, 1901.1,2, 1907.1, 1913.2,3; Schmidt, [E.] J. 1904.1; Solander, D. C. 1772.1; Tréhouart, F. T. 1838.1; Gaimard, P. Add. 1838.1 — *Works of travel, etc.* Olafsen, E. 1774.1; Olavius, O. 1787.1; Peyronie, G. 1832.1; Anderson, J. Pre-Linn. 1746.1; Olafsen, J. Pre-Linn. 1737.1

ITALY

General treatises: Text in Italian: Barbieri, C. 1907.3; ★Bonaparte, C. L. 1832.1, 1841.6; Canestrini, G. 1870.1; ★Costa, O. G. 1829.1; Griffini, A. 1903.1

General treatises: fresh-water fishes. ★Canestrini, G. 1866.1, 1866.2; Plehn, M. 1908.1; ★Supino, F. 1916.1

Bibliographies. Cavanna, G. 1880.1; McKenzie, K. 1905.1; Serpe, G. 1788.1

Misc. and general: *Marine fauna of various localities*. Bonelli, F. A. 1819.1; Carruccio, A. 1912.1; Coste, J. J. 1855.2, 1861.1, 1866.2; Filippi, F., & Verany, J. B. 1859.1; Franco, G. 1911.1; Giovane, G. M. 1829.1; Parona, C. 1908.1 — *See also Adriatic Sea under Mediterranean*.

Fresh-water fauna of various localities. Giglioli, E. H. 1879.1, 1880.1; Heckel, J. J. 1844.1; Martens, E. 1857.1; Pavesi, P. 1880.3; *Distribution*. Vinciguerra, D. 1905.1

Early references in Pre-Linn. section. Robinson, T. 1717.1; Salviani, H. 1554.1

Bergamo: (*Prov.*) Gervasoni, T. 1899.1

Caserta: (*Prov.*), *Gulf of Gaeta*. Giordano, D. 1890.1

Como: (*Lake and Prov.*), *Lake of Como*. Barbieri, C. 1907.1, 1908.3; Bellotti, C. 1906.1; Besana, G. 1901.1, 1908.2; Gatti, M. A. 1897.1; Monti, M. 1846.1, 1864.1; Zacharias, E. O. 1905.2; Anon. 420. — *Early references to Lake Como in Pre-Linn. section*. Camilli, C. 1561.1; Giovio, B. 1524.1; Giovio, P. 1561.1 — *Lake Varano*. Bellotti, C. 1904.1; Chiappi, T. 1902.1; Mazzarelli, G. 1906.1

Ferrara: (*Prov.*), *Lake Comacchio*. Bullo, G. S. 1894.1; Montanus, E. 1911.1; Verga, D. 1841.1

Garda Lake: (*Benaco lake*) Betta, F. E. 1891.1; Gatti, M. A. 1897.1; Heckel, J. J. 1851.1, 1852.5; Holland, T. 1879.1; Kammerer, P. 1908.1; Volta, G. S. 1789.1; Zacharias, E. O. 1905.2

Fauna — *Cont'd.*

Genoa: (*Prov.*), *Gulf of Genoa*. Ariola, V. 1904.1–1913.1; Bonaparte, C. L. 1842.2; Canestrini, G. 1861.1–1864.1; Damiani, G. 1896.2, 5; Faujas de Saint-Fond, B. 1806.1; Parona, C. 1909.1; Perugia, A. 1897.1; Ramorino, G. 1861.1; Sassi, A. 1846.1, 2; Spinola, M. 1807.1; Verany, J. B. 1846.1; Vinciguerra, D. 1879.1, 1883.2

Liguria: *see Genoa.*

Lombardy: (*Comp.*), *see also Bergamo, Como, Mantua and Sondrio Provinces*. Filippi, F. 1844.1, 1861.3; Pavesi, P. 1896.1; — "*Insubria*," *General treatise, text in Latin*. Scopoli, G. A. 1786.1

Lugano Lake: *see under Switzerland, Ticino.*

Maggiore, Lake: Zacharias, E. O. 1905.2; Moriggia, P. Pre-Linn. 1603.1

Mantua: (*Prov.*) Ottoni, G. 1852.1

Modena: (*Prov.*), *Catalogue*. Bonizzi, P. 1869.1 — *Other papers*. Canestrini, G. 1864.1, 1865.1; Picaglia, L. 1907.1

Naples: (*Prov.*), *Marine fauna of Gulf of Naples*. Borc a, J. 1907.2, 3; Br cher, K. 1912.1; Costa, A. 1857.1, 1871.1; ★Costa, O. G. 1829.1–1868.1; Emery, C. 1880.1; Giglioli, E. H. 1882.1, 1883.1; Lo Bianco, S. 1908.1–1911.2; Raffaele, F. 1887.1, 1888.1, 1889.1; Anon. 735 — *Lake of Fusaro*. Carazzi, D. 1900.1 — *Capri I.* Lo Bianco, S. 1901.1–1904.1

Padua: (*Prov.*) Arrigoni degli Oddi, E. 1895.1 — *Euganean Hills*. Issel, R. 1901.1 — *Lake Arqu *. Canestrini, G. 1866.3; Nardo, G. D. 1865.1; Visiani, R. 1865.1, 1866.1

Perugia: (*Prov.*), *Lake Trasimeno or Perugia*. Filippo, S. 1892.1; Misuri, A. 1915.1; Spariani, A. 1880.1

Piedmont: (*Comp.*) Festa, E. 1892.1; Filippi, F. 1859.1; Giorna, M. E. 1804.1; — *Aosta valley, Turin Province*. Pavesi, P. 1904.1

Roma: (*Prov.*), *Marine fauna*. Caruccio, A. 1896.1, 1912.1; Diorio, V. 1869.1; Vescovi, P. 1896.1 — *Tiber R. and Pontine marshes*. Vinciguerra, D. 1900.1, 1902.1

Sondrio: (*Prov.*) Carlini, A. 1888.1; Galli-Valerio, B. 1910.1; Monti, M. 1864.1; Anon. 420.

Teramo: (*Prov.*), *Fresh-water fauna*. Gatti, M. A. 1896.1 — **Synopsis**. Lopez, C. 1893.1

Tuscany: (*Comp.*), and *Tuscan Archipelago*. — *Grosetto, Prov., Orbetello Lagoon*. Biozzi, B. 1880.1 — *Caldana*. Bonaparte, C. L. 1840.5 — *Giglio I.* Borsieri, C. 1904.3 — *Arno River*. Canestrini, G. 1867.1 — *Arrezzo Prov.* Cecconi, G. 1903.1 — *Elba I.* Damiani, G. 1892.1–1913.1 — *No def. loc.* Senna, A. 1913.1

Umbria: *see Perugia.*

Venetia: (*Comp.*), *see Padua, Venice, Verona, and Vicenza Provinces.*

Venice: (*Prov.*), *Fresh-water fauna*. Heckel, J. J. 1851.3; Martens, E. 1858.1; Ninni, E. 1907.1 — *Marine fauna of Gulf of Venice*. Brusina, S. 1870.1; Chierighini, S. 1870.1; Grisellini, F. 1766.1, 1768.1, 2; Naccari, F. L. 1822.1–1824.1; Nardo, G. D. 1841.1, 1847.2, 3, 1873.1; Ninni, A. P. 1870.1, 1872.3, 1877.1; Ninni, A. P., & Trois, E. F. 1880.1 (*Catalogue*); Ninni, E. 1900.1, 1904.2, 1906.2; Olivi, G. 1792.1, 1796.2; Asseler, T. Pre-Linn. 1686.1; Donati, A. Pre-Linn. 1631.1

Verona: (*Prov.*) Betta, F. E. 1862.1, 1863.1.

Vicenza: (*Prov.*) Alver , A. [n. d.]; Serpe, G. 1788.1; Torossi, G. B. 1887.1, 2

LUXEMBURG

General treatise. La Fontaine, A. 1865.1 — *Sauer River*. Ferrant, V. 1896.1

MALTESE ISLANDS

Malta, and Gozo: *Catalogues with vernacular names*. Barbaro, G. C. 1869.1; Gulia, Gavino. 1860.1, 1861.1, 1862.1; Trapani, G. 1838.1 — *Bibliography*. Gulia, Giov. 1909.2 — *Gozo I.* Gulia, Giov. 1909.1–1910.1 — *Malta I.* Adams, A. L. 1870.1; Gulia, Gav. 1858.1–1877.1; Martin, M. 1834.1; Vinciguerra, D. 1883.2 — *See also Sicily, below.*

MEDITERRANEAN SEA

See also under surrounding countries and islands.

General treatises. ★Carus, J. V. 1893.1; ★Doderlein, P. 1881.1; Gouriet, E. 1894.11 — *Various papers*. Canestrini, G. 1864.2, 3, 1865.1, 1868.1, 2; Carpenter, W. B. 1872.1; Cuvier, G. 1814.2; Forsk l, P. 1775.1, 1776.1; Geoffroy-Saint-Hilaire, I. 1827.1; Giglioli, E. H. 1884.1, 1889.1, 1893.1; Kyle, H. M. 1913.1; Marion, A. F. 1883.2; Ostenfeld, C. E. 1912.1; Richard, J. 1905.1; Roule, L. 1907.1, 1909.3, 1910.1; Sars, M. 1856.1; Schoondermark, I. J. 1873.1; Vinciguerra, D. 1883.1, 1909.1 — *Influence of Suez Canal on intermigrations of Mediterranean and Red Sea faunas*. Krukenberg, C. F. Add. 1882.1 — *Early references in Pre-Linn. section*. Belon, P. 1553.2; Dapper, O. 1693.1; Gilles, P. 1535.2

Adriatic Sea: *Catalogues, general treatises, etc. Pop. treat. in English*. Faber, G. L. 1883.1; *Technical treatises in Italian*. Nardo, G. D. 1860.1; ★Ninni, E. 1912.1; Olivi, G. 1792.1, 1796.2; Perugia, A. 1866.1, 1881.1; Stossich, M. 1880.2; Trois, E. F. 1875.1; *Comment on Stossich, M. 1880.2* Kolombatovi , J. 1880.1

Various papers. Br nnich, M. T. 1768.1; Cori, C. J. 1910.1; Lambl, D. 1854.1; Michahellis, C. W. 1829.1–1830.2; Nardo, G. D. 1824.1–1826.1; Ninni, A. P. 1872.1, 1882.1, 2, 1883.1, 1903.4; Ninni, E. 1903.4; Paolucci, C. 1908.1; Paolucci, L. 1901.1, 1910.1; Parona, C., & Perugia, A. 1889.1–1892.1; Renier, S. A.

1847.1; Schmarda, L. K. 1847.1; Senoner, A. 1868.1; Steindachner, F. 1883.1; Steindachner, F., & Kolombatović, G. 1884.1; Steuer, A. 1913.1, 1914.1; Trois, E. F. 1867.2-1909.4; Volpi, — 1796.1 — *Comparison with North Sea fauna.* Sara, M. 1850.1 — *Early ref.* Giovio, P. Pre-Linn. 1527.1.

MONACO

See also neighboring localities such as Nice under France, Alpes-Maritimes, above. Fage, L. 1910.1; Perty, J. A. 1832.1.

NETHERLANDS

General treatises: Aalderink, H. 1899.1; Anslin, N. 1820.1, 1828.1; Schlegel, H. 1862.1, 1869.1, 1870.1.

Catalogues, lists, etc. Bemmelen, A. 1866.1, 2; Bennet, J. A., & Oliver, G. 1824.1; Man, J. C. 1870.1; Redeke, H. C. 1915.1; Anon. 379, *Bibliography* Anon. 127.

Early references in Pre-Linn. section. Gronovius, J. 1741.1; Gronovius, L. 1757.2; Guicciardini, L. 1648.1.

Fresh-water fauna: Ende, W. P. 1851.1; Hoek, P. P. 1891.4; Macks, J. A. 1878.1; Pleyte, W., & others. 1895.1; — *Groningen (Prov.), List.* Swinderen, T. 1826.1.

Marine fauna: (chiefly.) Beaufort, L. F. 1911.1; Boeke, J. 1906.1; Hasselt, A. W. 1855.1; Hubrecht, A. A. 1878.1; Kerbert, C. 1884.1; Lidth de Jeude, T. W. 1889.1; Loman, J. C. 1900.1; Maitland, R. T. 1851.1; Redeke, H. C. 1900.3, 1904.1, 1905.3, 1911.2; Reuvsen, C. L. 1897.2 **Zuyder Zee:** Hoek, P. P. 1890.2, 3, 1892.1; Redeke, H. C. 1908.1; Tesch, J. J. 1914.1; Weber, M. C. 1902.1.

NORTH SEA

See also under surrounding countries.

Literature of the ten principal food fishes. ★Hoek, P. P. 1903.1 — *Comparison with Adriatic Sea.* Sars, M. 1850.1 — *Plankton investigations.* Boeke, J. 1906.1; Ehrenbaum, E. 1911.4; Hoek, P., & Ostensfeld, C. 1906.1 (*Catalogue*); Ostensfeld, C., & Wesenberg-Lund, C. 1909.1; Riddell, W. 1912.1.

North Sea fauna: biological and physical conditions, investigations, etc. Bowman, A. 1914.1; Cordeaux, J. 1866.1; Cunningham, J. T. 1895.2, 3, 7; Cunningham, R. O. 1895.1; Dampf, — 1908.1; Day, F. 1884.5, 7; Dreyer, A. 1905.1; Garstang, W. 1909.2; Holt, E. W. 1891.2; Johnstone, J. 1903.3, 1904.5; Jungersen, H. F. 1898.1, 1899.1, 1905.1; Karsten, G. 1880.1, 1882.1; Kollmann, E. 1909.1; Lakowitz, C. 1908.1; Lee, R. M. 1909.1-1912.1; Mann, A. T. 1780.1; Redeke, H. C. 1911.3, 4, *Catalogue* 1915.1; Strodtmann, S. 1908.1; Wollman, E. 1908.1; Zernov, S. A. 1913.2.

NORWAY

General treatises: ★Collett, R. 1871.1, 1874.1, 1875.2; Lilljeborg, W. 1884.1; Wright, W. 1893.1.

Early natural histories, Pre-Linn. section. Pontoppidan, E. 1752.1; Ramus, J. 1715.1.

Distribution. Collett, R. 1874.1, 1875.2, 3; Helland, A. T. 1908.1; Kiær, H. 1905.1 — *Evidence for a Scottish-Norwegian land bridge.* Stejneger, L. 1909.1.

Works of travel and sport with incidental references to the fauna. Brian, A. 1905.1; Fabricius, J. C. 1779.1, 1785.1, 1802.1; Friis, J. A. 1876.1; Heuglin, M. T. 1872.1, 1874.1; Rasch, H. H. 1836.1; Rekstad, J. B. 1906.1.

Popular sporting works. (Text in English) Bowden, J. 1869.1; Lloyd, L. 1867.1; Sandeman, F. 1895.1.

Marine fauna of various localities: Ascanius, P. 1772.1; Berthoule, A., & Vaillant, L. 1889.1; Brunchorst, J. 1898.1; ★Collett, R. 1871.1-1913.1; Düben, M. W. 1844.1-1845.2; Düben, M. W., & Koren, J. 1844.1, 1845.1, 2; Esmark, L. 1844.1, 1862.1, 1871.1; ★Grieg, J. A. 1886.1-1913.1, Add. 1913.1; Gunner, J. E. 1763.1-1770.2; Hjort, J. 1895.1, 1907.1, 1908.2, 1909.1; Hjort, J., & Gran, H. H. 1900.1; Lindman, C. A. 1883.1; Nordgaard, O. 1896.1-1914.1; Sars, M. 1867.1; Sundevall, C. J. 1840.2 — See also North Sea. For Skagerak, see under Denmark.

Fresh-water fauna of various localities: Gaimard, J. P. 1842.1; Hintze, A. 1894.1; Huitsfeldt-Kaas, H. 1906.1; Krøyer, H. N. 1847.1; Liljeborg, N. 1844.1, 1845.1; Prentun, J. 1905.1.

Finmarken: Chiefly marine fauna. Collett, R. 1913.1; Esmark, L. 1868.1, 1875.1; Iversen, T. 1907.1, 1909.1; Leem, K. 1767.1; Malmgren, A. J. 1868.1; Prytz, L. J. 1821.1; Sars, G. O. 1879.3, 1883.1; Lemnius, C. Add. 1767.1.

Trondhjem: Chiefly fauna of Trondhjem-fjord. Dahl, K. 1903.2; Huitsfeldt-Kaas, H. 1913.1; Nordgaard, O. 1909.2, 1914.1; Storm, V. J. 1883.1, 1884.1; Swenander, G. 1906.1.

PORTUGAL

Catalogues: Capello, F. 1868.1, 1870.1, 2, 1873.1, 1876.2, 1881.1; Seabra, A. F. 1911.1; Steindachner, F. 1864.3; Vieira, L. 1894.2, 1897.1, 1898.1, 1900.1, 1901.1 — *Prologue to catalogue of Capello, F.* Bocage, J. 1881.1 — *Appendices to catalogue of Capello.* Osorio, B. 1886.1, 1894.1, 1895.3, 1897.1, 1906.4.

Fresh-water fauna: Catalogues. Steindachner, F. 1864.3; Vieira, L. 1894.2 — *Other papers.* Moller, A. F. 1894.1; Nobre, J. 1894.1, 1909.1; Steindachner, F. 1866.1, 5; Vandelli, D. 1797.1 — *Duero, Guadiana, and Tagus Rivers.* Steindachner, F. 1865.1, 1866.4.

Marine fauna: Bocage, J. V., & Capello, F. 1864.1, 2, 1866.1; Capello, F. 1868.2-1870.4; Cligny, A. 1905.1, Add. 1913.1; Girard, A. A. 1892.1-1895.1; Guimaraes, A. R. 1882.1; Holten, H. S. 1802.2; Lütken, C. F. 1894.1; Neuville,

Fauna — Cont'd.

H. 1897.2; Nobre, A. 1895.1, 2, 1897.1; Osorio, B. 1897.1, 1906.2, 1909.1, 1911.1; Seabra, A. F. 1913.1; ★Steindachner, F. 1867.3; Vieira, L. 1897.1–1901.1; Wright, E. P. 1868.1.

Algarve: (Prov.) Almeida, F., & Chagas, R. 1892.1; Bonnet, C. 1850.1; Capello, F. 1870.3; Girard, A. A. 1892.1; Nobre, A. 1895.5; Anon. 426.

RUMANIA

Fresh-water fauna: General treatise. ★Antipa, G. 1909.1 — *Various papers.* Antipa, G. 1894.1–1911.1; Maksimov, N. E. 1909.1–1913.2; Dobrudja, Tultcha. Steindachner, F. 1863.11.

For marine fauna, see Black Sea, above.

RUSSIA

For Asiatic Russia; see Russian Central Asia, and Siberia under Asia.

General treatises: *Text in French.* ★Berg, L. S. 1912.2; Blanc, E. 1900.1 — *Text in Russian.* ★Gracianov, V. I. 1907.5; Sabanyeev, L. P. 1874.1, 1911.1; Varpakhovskii, N. A. Add. 1898.1; *Comment on Gracianov.* Berg, L. S. 1909.4.

Bibliography; résumé of Russian researches in biology, limnology, etc. Pogorzelskij, V. A. 1904.1; Schokalsky, J. M., & Schmidt, P. J. 1907.1; Varpakhovskii, N. A. 1888.1.

Works of travel with references to the Russian fauna. Demidoff, A. N. 1840.1; Georgi, J. G. 1797.1; Gmelin, S. G. 1770.1; Guldensadt, A. 1787.1; Lepekhin, I. I. 1774.1; Pallas, P. S. 1771.1, 1788.1.

Miscellaneous items. Forsström, O. A. 1895.1; Golowatschow, A. 1857.1; Gracianov, V. I. 1904.1, 1907.1, 4; Hofer, J. 1909.1; Jablonskii, N. I. 1907.1 (*Marka-Kul See*); Richters, F. 1890.1; Ruzsky, M. D. 1887.1; Varpakhovskii, N. A. 1889.1; Zograf, N. Y. 1895.1, 1896.1.

Archangel: (Govt.) *White Sea or Karelian coast.* Bergroth, I. O. 1895.1; Chydenius, J. J., & Furuholm, J. E. 1859.1; Nylander, W. 1852.1; Rosberg, J. E. 1892.1 — *Kolgujef I.* Mikhailovskii, M. M. 1903.3 — *Petschora R.* Varpakhovskii, N. A. 1901.1.

Baltic Provinces: Seidlitz, G. 1877.1 — *Duna R.* Plater, A. 1861.1 — *Esthonia, Gulf of Finland at Reval.* Schneider, G., Levander, K. M., Husen, E., & others. 1908.1 — *Gulf of Riga.* Schweder, G. 1893.1, 1894.1, 1911.1 — *Lake Peipus.* Baer, K. E. 1851.1; Zur Mühlen, M. 1908.3, 1911.27 — *Livonia.* Bruttan, — 1888.1; Dybowski, B. I. 1864.1; Fischer, J. B. 1791.1; Mierzejewski, L. 1910.1 (*Oesel I.*); Schneider, G. 1909.1, 1911.1 — *St. Petersburg Govt.* Fischer, J. 1875.1; Kessler, K. T. Add. 1864.1 — *Courland.* Rhanæus, S. Pre-Linn. 1725.1.

Caspian Sea: Baird, S. F. 1873.12; Berg, L. S. 1913.5, 12; Borodin, N. A. 1896.1, 1904.1, 1905.2, 1906.1; Eichwald, C. E. 1838.1, 1841.1, 1842.1; ★Kessler,

K. T. 1877.1; Knipovich, N. M. 1904.1–1906.1; ★Lönnberg, A. J. 1900.2, 10; Satunin, K. A. 1907.1; Sodoffsky, W. 1849.1; Suvorov, E. K. 1910.1, 1913.1 — *Comparison with Baltic Sea.* Lönnberg, A. J. 1899.6 — *Comparison with Black Sea.* Kessler, K. T. Add. 1874.1 — *Early reference.* Olearius, A. Pre-Linn. 1662.1.

Caucasus: (Govt.), *see also Black and Caspian Seas.* Berg, L. S. 1899.1, 1906.1, 1910.2, 1913.6; Eichwald, C. E. 1842.1; Kamenskii, S. N. 1897.1; Kavraiskii, T. T. 1896.1, 1897.1, 1899.1; Sauvage, H. E. 1882.1 — *Kuban R.* Berg, L. S. 1912.3, 1913.4; Grünberg, V. Add. 1914.1, 2. **Trans-Caucasia:** Berg, L. S. 1910.3; Derjugin, K. M. 1899.1, 2; Nordmann, A. 1840.1; Radde, G. F. 1886.1; Wilbraham, R. 1839.1 — *Erivan, Goktscha Lake.* Grimm, O. 1906.1; Laister, A. 1908.1 — *Kur R. and lakes of Kars and Tiflis.* Kavraiskii, T. T. 1901.1.

Don River and basin: Czernáy, A. 1857.1; Kamenskii, S. N. 1896.2; Ruzsky, M. D. 1888.1; Tchihatcheff, P. 1856.2.

Ilmen, Lake and Novgorod (Govt.) Kuchin, I. B. 1903.1; Lebedintsev, A. A. 1908.1; Varpakhovskii, N. A. 1886.1.

Ladoga, Lake: Genetz, A. T. B. 1899.1; Jääskeläinen, V. 1910.1; Skorikov, A. S. 1910.1.

Lapland: *See also Finland, below.* Castrén, S. 1803.1; Enckell, N. 1790.1; Fabritius, W. 1910.1; Fellman, J. 1844.1; Nordqvist, O. F. 1900.2; Nylander, A. E. 1857.1 — *Littoral fauna of Murman Coast.* Goebel, H. 1906.1; Knipovich, N. M. 1897.2–1903.1, 1906.2, 3, 1907.2, 1911.2; Levander, K. M. 1901.1; Lönnberg, A. J. 1900.4; Pfeffer, G. J. 1890.1 — *Early references, Pre-Linn. section.* Högström, P. 1748.1; Scheffer, J. 1673.1.

Nova Zembla I.: Heuglin, M. T. 1872.1, 1874.1; Le Danois, E. 1913.1; Markham, A. H. 1881.1; Spoerer, J. 1867.1; Stuxberg, A. J. 1886.1.

Onega, Lake: Mikhailovskii, M. M. 1903.2.

Poland: Walecki, A. 1864.1, 1890.1 — *Manual.* Kotarbinski, E. 1909.1 — *List.* Taczanowski, L. 1877.1 — *Early natural history.* Rzaczynski, G. Pre-Linn. 1721.1.

South Russia: South-western Russia. Kessler, K. T. 1856.1 — *Odessa.* Kiselevich, K. 1908.1 — *Dnieper, Dniester and Bug Rivers.* Tchihatcheff, P. 1856.2 — *Dnieper Basin, General treatise.* ★Emeljanenko, P. Add. 1914.1. **Crimea:** Demidoff, A. N. 1840.1; Kessler, K. T. 1859.3, 1878.1; Nikolskii, A. M. 1891.2; Rathke, M. H. 1837.1.

Volga River and basin: Aleksandrov, K. P. 1909.1, 1910.1; Bazenov, A. 1905.1–1906.2; Borodin, N. A. 1905.3; Derzhavin, A. 1913.1; Dikson, B. 1905.2, 3; Kuznetzov, I. D. 1904.1, 1908.1; Lavrov, S. 1908.1; Ruzsky, M. D. 1893.1; Terechenko, K. K. 1912.1, 1913.1; Yakovlev,

V. E. 1871.1 — *Vyatka (Govt.)*, Kama R. Berg, L. S. 1911.2 — *Perm (Govt.)* Goly-netz, W. 1894.1; Samarine, C. A. 1904.1 — *Saratov*. Grimm, O. 1904.1 — *Astrachan (Govt.)* Suvorov, E. K. 1907.1, 2 — *Simbirsk (Govt.)*, Sura R. Varpakhovskii, N. A. 1884.1 — *Kazan (Govt.)* Varpakhovskii, N. A. 1886.2.

Finland

General treatises: Levander, K. M. 1907.1; ★Malmgren, A. J. 1863.1; Mela, A. J. 1882.1; ★Reuter, O. M., & Mela, A. J. 1883.1.

"*Bibliotheca zoologica Fenniae*." Reuter, O. M., & Luther, A. 1909.1.

Miscellanea: Aulin, H. 1760.1; Bell, R. 1899.1; Brenner, M. M. 1896.1; Carlsson, W. 1869.1; Cederström, G. C. 1894.2; Collin, A. 1904.1; Elmgren, S. G. 1852.1, 1858.1; Eurén, G. E. 1859.1; Fagerlund, L. W. 1878.1; Forssell, A. L. 1905.1; Gadd, P. A. 1761.1, 1769.1, 1771.1; Gejtel, N. 1898.1; Gottberg, G. 1910.1, 3, 5; Hintze, H. 1893.1; Hurmalainen, J. 1908.1; Indrenius, M. A. 1785.1; Järvi, T. H. 1909.5; Kahilainen, W. 1899.1; Knorring, F. P. 1833.1; Levander, G. V. 1906.1; Levander, K. M. 1900.3; Luther, A. F. 1904.1, 1910.1; Mäklin, F. W. 1853.1, 1869.1, 1871.1; Mela, A. J. 1881.2, 1883.3, 1903.1, 2; Mellenius, S. G. 1789.1; Moberg, A. 1857.1–1894.1; Nordlund, B. F. 1866.1; Nordmann, A. 1857.1, 1865.1; Nordqvist, O. F. 1903.4, 5; Palmén, J. A. 1874.1–1881.4; Porthan, H. G. 1777.1, 1794.1; Renvall, T. 1899.1; Reuter, O. M. 1876.1, 1888.1; Sadelin, P. U. 1810.1; Salenius, J. M. 1871.1; Sandman, J. A. 1904.1, 2, 1905.2, 5; Schultén, A. B. 1874.1; Siebold, C. T. 1866.1; Sievers, K. R. 1876.2, 3; Stenroos, K. E. 1893.1, 1895.1, 1900.1; Suomalainen, E. W. 1905.1–1908.2, 1910.1, 1911.1; Tammelander, K. 1903.1; Westerland, A. 1898.1, 2; Wikström, D. A. 1893.1.

Abo-Björneborg: (Govt.) Carlsson, W. 1871.1; Grönfeldt, G. 1871.1; Helenius, C. N. 1786.1; Justander, J. G. 1786.1; Mentzer, C. 1782.1; Pettersen, W. 1824.1.

Aland Archipelago: Mela, A. J. 1900.1; Olsson, P. H. 1895.1; Pavlovich, S. A. 1909.1; Radloff, F. W. 1795.1 — *Korpo I.* Fagerlund, L. W. 1878.1; Myrén, O. 1899.1.

Kuopio: (Govt.) Rein, G. 1846.1, 1864.1; — *Kalla Lake*. Suomalainen, F. W. 1910.2, 3.

Nyland: (Govt.) *Fresh-water fauna*. Heinricius, J. 1895.1; John, H. H. 1789.1; Stenroos, K. E. 1898.1; Wahlberg, A. 1913.1 — *Marine fauna of Gulf of Finland*. Bianchi, V. 1907.1; Brünnich, M. T. 1788.2; Hagström, C. P. 1885.1, 2; Häyrén, E. 1900.1; Levander, K. M. 1901.5; Nordmann, A. 1853.1; Reuter, O. M. 1892.1; Schneider, G. 1904.3, 14, 19; Schneider, G., & Levander, K. M.

1900.1; — *Hogland I.* Sievers, K. R. 1876.1.

Tavastehus: (Govt.) Bucht, J. F. 1792.1; John, H. H. 1789.1; Lindfors, A. M. 1895.1; Lundén, M. 1797.1.

Uleaborg: (Govt.) Castrén, E. 1776.1; Hougberg, E. 1886.1; Lagus, E. 1776.1; Rein, G. 1847.1, 1867.1; Runeberg, E. O. 1758.1; Fornæus, J. J. 1772.1; Jääskeläinen, V. Add. 1913.1.

Vasa: (Govt.) Backman, K. A. 1852.1 (*Jalasjärvi*); Frosterus, E. J. 1826.1; Juselius, — 1905.1; Juvelius, E. 1772.1 — *Keitele Lake*. Luther, A. F. 1902.1.

SARDINIA

Fresh-water fauna. Boulenger, G. A. 1900.15 — *Marine fauna, chiefly*. Carruccio, A. 1870.1, 1910.1; Cetti, F. 1777.1; Lovisato, D. 1896.1; Parona, C. 1883.1; Targioni-Tozzetti, A. 1870.1.

SERVIA

Text in Servian. Abstract in German. Panchic, I. 1860.1.

SICILY

See also Italy, and Maltese Islands.

General treatises. ★Doderlein, P. 1872.1, 1878.2, 1881.1; Rafinesque, C. 1810.1, 2, 1814.3 — *Marine fauna, chiefly*. Alessi, G. 1836.1; Carruccio, A. 1870.1; Doderlein, P. 1872.1–1888.1; Domen, M. S. 1905.1; Filippi, F., & Verany, J. B. 1859.1; Maurolico, F. 1891.1–1893.1; Mazzarelli, G. F. 1908.2; Monti, R. 1910.1; Riggio, G. 1882.1; Sicher, E. 1896.1; Spallanzani, L. 1772.1; Targioni-Tozzetti, A. 1870.1; Anon. 466.

Catania: *Marine fauna*. Gemmellaro, G. G. 1868.1; Mauro, S. D. 1905.1; Russo, A. 1913.2; Sicher, E. 1898.1; Tuttolomondo, A. 1901.1 (*Gen. treat.*); Zelarovich, A. 1913.1.

Messina: *Sea and Strait*. Cantraine, F. J. 1837.1, Add. 1835.1; Cialona, M. 1901.1; ★Cocco, A. 1831.1–1888.1; Cocco, A., & Scuderi, L. 1835.1; ★Facciola, L. 1881.1–1913.1; Kaup, J. J. 1860.4; Mazzarelli, G. F. 1910.1, 1912.1; Vinciguerra, D. 1883.2.

SPAIN

See also Balearic Islands.

General treatises: *Marine fishes*. Bowles, W. 1775.1, 1782.1; Cisternas, R. 1867.1; Navarrete, A. 1900.1; ★Steindachner, F. 1867.3.

Miscellanea: Balaguer y Primo, D. 1878.1; Camps y de Olzinellas, C. 1906.1; Chapman, A., & Buck, W. J. 1893.1; Cligny, A. 1905.1, Add. 1913.1; Cornide, J. 1788.1; Fernandez de los Senderos, F. 1850.1; Gallichan, W. M. 1904.1; Martin, M. 1834.1; Perez Arcas, L. 1872.2–1878.1; Colomina, A. Add. 1910.1 — *Animals mentioned by Cervantes in Don Quixote*. Colmeiro y Penido, M. 1895.1 — *Works of travel*. Descourtilz, M. E. 1809.1; Larruga, D. E. 1798.1; Osbeck, P. 1765.1,

Fauna — Cont'd.

1770.1, 1771.2; Willkommen, H. M. 1879.1 — *Atlas of 93 colored plates*. Anon. 448.

Fresh-water fauna: Asso y del Rio, I. 1784.1, 1801.1; Barras de Aragón, F. 1894.1; Machado y Nunez, A. 1856.1 (*Guadalquivir R.*); Steindachner, F. 1866.1, 5 — *Ebro and Minho Rivers*. Steindachner, F. 1866.3, 4.

Andalucia: Cabrera Latorre, A. 1887.1 — *General treatise*. Rosenhauer, W. G. 1856.1.

Barcelona: *Catalogues*. Graells, M. 1869.1; Sanchez-Comendador, A. 1904.1.

Cadiz: *Catalogue*. Machado y Nunez, A. 1856.1.

Cuenca: Steindachner, F. 1866.4.

Huelva: *Catalogue*. Machado y Nunez, A. 1856.1.

La Coruña: Bolido, B. M. 1797.1; Bolivar, I. 1907.1; Cornide, J. 1788.1; Graells, M. 1870.1.

Oviedo: Graino, C. 1905.1.

Valencia: *Catalogues*. Cisternas, R. 1867.1, 1877.1; Graells, M. 1869.1 — *Albufera de Valencia*. Steindachner, F. 1866.2.

SPITZBERGEN

Chiefly marine fauna. Albert I, H. C. 1900.1; Cocks, A. H. 1884.1; Ehrenbaum, E. 1905.1; Gaimard, J. P. 1842.1; Heuglin, M. T. 1872.1, 1874.1; Knipovich, N. M. 1901.2, 1903.3, 1907.1; Lönnberg, A. J. 1899.5; Malmgren, A. J. 1865.1, 2, 1867.1; Vaillant, L. L. 1894.1.

SWEDEN

General treatises: ★Fries, B. F., Ekstrom, C. U., & Sundevall, C. J. 1836.1, 1893.1; ★Lilljeborg, W. 1884.1; Linnæus, C. 1800.1; Nilsson, S. 1855.1; Palmstruch, J. W. 1809.1; Retzius, A. J. 1800.1 — *Mörkö Is.* Ekström, C. U. 1830.1, 1835.1; *German translation of this work*. Creplin, F. C. 1835.1.

Bibliography. Josephson, A. G. 1889.1; Lundberg, F. 1872.1.

Early natural histories in Pre-Linn. section. Artedi, P. 1738.1; Linnæus, C. 1746.1.

Fresh-water fauna: *Popular general treatise*. Widegren, H. 1870.1 — *Various papers*. Björkman, — 1785.1; Ekman, S. 1907.1–1912.1; Glogau, H. 1863.1; Hardin, S. 1862.1; Lilljeborg, W. 1872.1; Lönnberg, A. J. 1901.2, 3, 1903.10; Lundberg, R. 1899.1, 1901.2; Quennerstedt, A. 1877.1 — *Lake Mälaren*. Lönnberg, A. J. 1903.7, 1905.5 — *Lake Venern*. Widegren, H. 1863.2 — *Lake Vettern*. Ekman, T. 1902.1; Widegren, H. 1863.2.

Marine fauna: (*Chiefly*) Ascanius, P. 1772.1; Euphrasen, B. A. 1786.1–1795.1; Fries, B. F. 1837.1–1839.4; Gaimard, J. P. 1842.1; Hintze, A. 1894.1; Kroyer, H. N. 1847.1; Lloyd, L. 1867.1; ★Lönnberg, A. J. 1889.1–1912.2; ★Malm,

A. W. 1851.1–1887.1; Quensel, C. 1806.1; Sundevall, C. J. 1844.2, 1845.1, 1854.1; Radloff, F. W. 1805.1 — *Relation to Russian fauna*. Lilljeborg, W. 1857.1 — *Relics in the Swedish fauna*. Phillip, G. 1910.1 — *See also Baltic Sea, above*. For Kattegat, see under Denmark.

Göteborg and Bohus: Cederström, G. C. 1874.1, 1877.1; Ekman, T. 1904.1; Hansson, C. A. 1881.1; Ljungman, A. V. 1879.3, 1880.2; Lönnberg, A. J. 1907.6, 1908.4; ★Malm, A. W. 1877.2; Trybom, F. 1903.2.

Jemtland: Hammarström, C. 1901.1; Nystrom, C. L. 1863.1.

Malmöhus: Nilsson, S. 1832.1, 2 — *Ystad district*. Lönnberg, A. J. 1900.6 — *Landskrona (List)*. Schagerström, N. O. 1838.1, 1842.1 — *Skåne*. Schagerström, N. O. 1827.1, 1829.1, 1833.1.

Norrbottn: Widegren, H. 1860.1 — *Arjeplog*. Olofsson, O. 1915.1 — *Luleå*. Wheelwright, H. W. 1864.1.

SWITZERLAND

General treatises: (*Technical*) ★Fatio, V. 1868.1, 1882.1; Hartmann, G. L. 1827.1; Raveret-Wattel, C. 1900.1.

Popular general treatises. (Text in German) Schinz, H. R. 1837.1, 1840.1; Sulzer, J. 1880.2; Weber, J. C., & Kranz, C. A. 1870.1; Zschokke, F. 1905.2, 1912.1 — *See also "Die Süßwasserfische von Mitteleuropa," at beginning of this section of Fauna, Europe.*

Bibliography. Fischer-Sigwart, H. 1900.1.

Miscellanea: Asper, G. 1880.2, 1884.1; Berlepsch, H. A. 1864.1; Fatio, V. 1868.1–1905.4; Klunzinger, C. B. 1891.1; Lankester, E. R. 1912.1; Mayor, J. D. 1823.1; Anon. 220.

Early references in Pre-Linn. section. Baulacre, — 1738.1; Colerus, 1627.1; Scheuchzer, J. J. 1703.1; Scribonius, G. A. 1587.1.

Aargau: (*Canton*) Hofer, J. 1911.1, 4; Wey, A. 1887.1 (*Reuss R.*); Zur Mühlen, M. 1911.11.

Alpine lake-fauna: *Distribution, etc.* Filippi, F. 1861.3; Graff, L. 1887.1; Imhof, O. E. 1883.1–1894.1; Surbeck, G. 1913.2; Tschudi, F. 1872.1; Zacharias, E. O. 1905.2; Zschokke, F. 1890.1, 1895.1; Goll, J. H. Add. 1893.1 — *Abyssal fauna of Swiss lakes*. Du Plessis, G. 1885.1; Forel, F. A. 1872.1, 1874.2, 1878.1, 1885.1, 1910.1; Zschokke, F. 1900.1, 1911.1.

Bern: *Lakes of*. Hartmann, G. L. 1780.1; Heuscher, J. 1895.2 — *Stockhornsee*. Baumann, F. 1910.1 — *Bienne, Lake of (Bieler See)*. Fuhrmann, O. 1904.3, 1905.7; Perrot, L., & Droz, S. 1811.1; Razumovskii, G. 1789.1; Zur Mühlen, M. 1911.2.

Constance, Lake; or Bodensee: Bruhin, P. T. 1868.1; Chun, C. 1895.1; Fr., L. 1893.1; Hartmann, G. L. 1795.1, 1808.1; Klunzinger, C. B. 1884.2, 1892.1; Lochner von Hüttenbach, — 1904.1, 1907.1; Nenning, S. V. 1834.1; Nüsslin, O. 1882.1,

1901.1; Rapp, W. L. 1853.1, 1854.1; Schillinger, A. 1896.1; Schweizer, W. 1894.1, 1916.1; Siebold, C. T. 1858.1; Surbeck, G. 1903.1; Wartmann, B. 1777.2, 1783.1; Weismann, F. L. 1877.1; Mangolt, G. Pre-Linn. 1520.1.

Fribourg: (*Freiburg*) Musy, M. 1880.1 — *Morat, Lake.* (*Murtnersee*) Fuhrmann, O. 1904.3, 1905.7; Goll, H. 1907.1; Perrot, L., & Droz, S. 1811.1; Razumovskii, G. 1789.1.

Geneva, Lake: (*Lac Léman* or *Genfer See*), *General treatises.* ★Forel, F. A. 1901.1; Jurine, L. 1825.1; ★Lunel, G. 1874.1 — *Various papers.* Blanc, H. 1895.1; Chatelanat, H. 1874.1; Forel, F. A. 1866.1–1911.1; Gervais, F. L. 1874.1; Goll, H. 1882.1, 1892.2; Zacharias, E. O. 1905.2; Blanchard, E. Add. 1896.1; Yung, E. Add. 1914.2 — *Pre-Linn. references.* Du Villard, J. 1581.1; Fatio, J. C. 1731.1.

Glarus: (*Glaris*) Hofer, J. 1909.2 — *Wallensee and Linth R.* Steinmüller, J. R. 1827.1.

Grisons: (*Graubünden*) Birkholz, J. C. 1770.1; Brügger, C. G. 1874.1; Imhof, O. E. 1886.1; Lorenz, P. 1896.2, 1897.1; Siebold, C. T. 1863.2; Stein, J. G. 1873.1; Zur Mühlen, M. 1911.5; Anon. 224.

Lucerne: (*Canton*) *Hallwyler See.* Fatio, V. 1905.3 — *Sempacher See.* Fischer Sigwart, H. 1904.1, 1910.1; Stockmann, F. J. 1781.1; Wey, A. 1887.1.

Lucerne, Lake: (*Vierwaldstättersee*). Nufer, W. 1905.1 (*Gen. treat.*); Theil, — 1868.1; Wey, A. 1887.1; Cysat, J. Pre-Linn. 1661.1.

Neuchâtel, Lake: (*Neuenburger See*) Agassiz, J. L. 1834.2; Coxe, W. 1790.1 (*Catalogue*); Fuhrmann, O. 1904.3, 1905.7; Girardet, — & Girardet, — 1797.1; Goll, H. 1882.1, 1883.1; Perrot, L., & Droz, S. 1811.1; Razumovskii, G. 1789.1; Siebold, C. T. 1867.1; Vouga, P. 1866.1.

Schwyz: *Klöntalersee.* Heuscher, J. 1903.2.

Solothurn: (*Soleure*) Lang, F. V., & Wirz, A. 1880.1.

Thurgau: (*Thurgovie*) Kollbrunner, E. 1879.1, 2; Wehrli, E. 1892.1.

Ticino: (*Tessin*) Ghidini, A. 1910.1; Hofer, J. 1895.3, 1898.1, 1911.2; Lavizzari, L. 1859.1; Monti, M. 1864.1; Pavese, P. 1880.3, 1889.2, 1898.1, Add. 1873.1; Anon. 420 — *Lugano Lake.* Amberg, O. 1903.1; Fatio, V. 1905.4; Mazzarelli, G. F. 1904.2, 1905.3, 1909.1.

Unterwalden; Sarnen, Lake: (*Sarnensee*) Fatio, V. 1897.1, 2; Heuscher, J. 1901.2.

Vaud: (*Waadt*) Blanc, H. 1901.1; Forel, F. A. 1904.3; Razumovskii, G. 1789.1; Zur Mühlen, M. 1911.4.

Zug: (*Zoug*) *Zugersee.* Stadler, J. A. 1865.1.

Zurich: Amberg, O. 1900.1; Schoch, G. 1879.1–3, 1880.1, 1890.1; Schinz, H. R. Add. 1848.1 — *Pre-Linn. references.* Bluntschli, 1742.1; Füessli, J. 1709.1.

TURKEY

Work of travel. Olivier, G. A. 1802.1 — *Albania, Epirus.* Sauvage, H. E. 1880.4 — *Lake of Janina.* Steindachner, F. 1896.1.

OCEANICA

Inclusive of Indo-Australian or Malay Archipelago, Philippine Is., Hawaiian Is., Australia, New Zealand, etc.

Provisional check-list of the fishes of Oceanica. Jordan, D. S., & Seale, A. 1906.2.

Discussion on Wallace's line. Regan, C. T. 1912.11.

AUSTRALIA

General treatises

Lists, descriptive catalogues, etc. Gray, J. E. 1827.1; ★Macleay, W. 1881.1, 2, 1884.5, 1885.2; Richardson J. 1842.3 — *Synopsis, South Australia.* Zietz, A. H. Add. 1908.2.

Popular general treatises. Aflalo, F. G. 1896.1; Stead, D. G. 1906.1, 1908.1.

Fresh-water fauna

Phylogeny of the fauna. Haeckel, E. H. 1893.1 — *Distribution, relations with Asia.* Popta, C. M. 1912.3 — *Possible former connection with New Guinea.* Weber, M. C. 1907.3, 1908.1 — *Various localities.* Gervais, F. L. 1876.1 (*Fitzroy R.*); Günther, A. 1867.2, 1870.1, 2, 1870.2; Hall, T. S. 1905.1 — *King R.* Regan, C. T. 1906.2 — *Finke R.* Zietz, A. H. 1896.1.

Marine fauna

Various localities. Bleeker, P. 1859.7, 1862.5, 1865.9; Canestrini, G. 1869.2; Castelnau, F. L. 1872.1–1879.3; Dunccker, G. 1909.1; Elliott, S. 1858.1; Gray, J. E. 1851.2, 1859.1; Haswell, W. A. 1908.1; Kent, W. S. 1893.1, 1897.1; Klunzinger, C. B. 1872.1, 1880.1; Lacépède, B. G. 1804.1; Leach, W. E. 1819.1; M'Coy, F. 1865.1, 1873.1–1874.1; McCulloch, A. R. 1908.1–1914.4; Ogilby, J. D. 1885.2–1916.1; Ogilby & McCulloch, A. R. 1908.1, 1916.1; Peters, W. C. 1865.3; Ramsay, E. P. 1881.2; Regan, C. T. 1909.7; Rennie, E. H. 1903.1; Richardson, J. 1840.1–1850.1; Richardson, J., & Gray, J. E. 1844.1; Solander, D. C. 1768.1; Steindachner, F. 1884.1; Thominot, A. 1880.2, 1881.1, 1883.2; Tilesius von Tilenau, W. G. 1820.1; Waite, E. R. 1898.1, 2, 1899.4, 1900.3, 4, 1901.3, 1902.1, 2, 1904.4, 5, 1905.3, 1906.1 — *Freemantle.* Günther, A. 1861.8 — *King George's Sound.* Jenyns, L. 1842.1; Macleay, W. 1879.1; Richardson, J. 1845.1, 1850.1; Neill, J. Add. 1845.1 — *Monte Bello Is.* Montague, P. D. 1914.1 — *Port Darwin.* Macleay, W. 1878.1; Kent, W. S. Add. 1889.1 — *St. Vincents Gulf.* Haacke, J. W. 1885.1 — *Torres Straits.* Macleay, W. 1877.2.

Fauna — Cont'd.**Works of travel**

Banks, J. 1896.1; Dahl, K. 1897.1; Phillip, A. 1789.1; Semon, R. W. 1896.2, 1899.1, 1903.1; Banfield, E. J. Add. 1911.1, 1913.1; Bennett, G. Add. 1834.1; Ward, T. Add. 1907.1.

New South Wales: *Popular general treatises, catalogues, etc.* Stead, D. G. 1908.1; Waite, E. R. 1904.7, 1905.2; ★Woods, J. E. 1882.1, 2; ★Ogilby, J. D. Add. 1887.1, 1893.1 — **Fresh-water fauna.** Bennett, G. 1864.1; Günther, A. 1871.3 (*Macquarie R.*); Hill, E. S. 1864.1 (*Murray R.*); Krefft, J. L. 1864.1, 1867.1; Macleay, W. 1885.1 (*Murrumbidgee R.*); Ogilby, J. D. 1895.1; Stead, D. G. 1906.3, 1907.3; Zietz, A. C. 1902.1 **Marine fauna, chiefly from Port Jackson at Sydney.** Bennett, G. 1859.1, 1860.1, 1870.1; Bleeker, P. 1863.16; Castelnau, F. L. 1878.1; Farnell, F., & Neilsen, C. A. 1898.1; Farnell, F., & Waite, E. R. 1898.1; McCulloch, A. R. 1911.1, 1914.1, 2, 1916.2; Macleay, W. 1879.1, 1881.3, 1883.2, 4, 1884.3, 4, Add. 1882.3, 1885.1; Martin, M. 1834.1; Ogilby, J. D. 1885.1, 3, 1890.1; Ramsay, E. P. 1881.3–1884.1; Ramsay & Ogilby, J. D. 1885.1–1889.1, Add. 1888.1; Schnee, S. 1903.2; Stead, D. G. 1900.1–1908.3, Add. 1907.3–1911.1; Steindachner, F. 1866.19; Waite, E. R. 1894.1, 1899.3, 5; Haswell, W. A. Add. 1906.1.

Queensland: *Fresh-water fauna.* Castelnau, F. L. 1878.2–1879.2; Günther, A. 1864.7, 1871.4, 1872.1; Kent, W. S. 1892.1; Krefft, J. L. 1864.1–1871.2; Macleay, W. 1883.3, 1884.1, Add. 1883.1; Spencer, W. B. 1892.2 — *Rockhampton.* Steindachner, F. 1867.7 — *Barcoo R.* Zietz, A. H. 1896.1 — *Marine fauna.* Alleyne, H. G., & MacLeay, W. M. 1877.1; De Vis, C. W. 1883.1–1892.1, Add. 1884.3–1886.3; Garman, S. 1903.1; Jouan, H. 1878.1; Krefft, J. L. 1870.1, 2, 1871.1; McCulloch, A. R. 1914.1, 1916.2; O'Connor, D. 1886.2; Ogilby, J. D. 1904.1–1915.2; Steindachner, F. 1867.10; Tosh, J. R. 1903.1, 2.

Victoria: *General treatises, lists, etc.* Kingsbury, W. H. 1896.1; Lucas, A. H. 1890.2, 1896.1; M'Coy, F. 1878.1 — *Various papers, chiefly marine fauna.* Becker, L. 1857.2; Castelnau, F. L. 1872.1, 1874.1; Fowler, H. W. 1907.1; Günther, A. C. 1861.6, 1863.2; Kershaw, J. A. 1901.1–1913.1; Lucas, A. H. 1890.1–1897.1, Add. 1889.1; McCulloch, A. R. 1911.1, 1914.1, 1916.2 — *Kent Is.* Gabriel, J. Add. 1891.1.

Lord Howe I.: *Catalogue.* ★Waite, E. R. 1904.3 — *Various papers.* Ogilby, J. D. 1891.1, 1899.1, Add. 1889.2; Waite, E. R. 1900.1, 1901.1, 1903.1, 1904.1; Waite, E. R., & McCulloch, A. R. 1916.1; Ramsay, E. P. Add. 1882.1 — *Comparison with Kermadec and Norfolk Is.* Waite, E. R. 1910.1.

Norfolk I.: Forster, J. H. 1844.1; Ogilby, J. D. 1888.2 — *List and comparison with Lord Howe I.* Waite, E. R. 1910.1.

Tasmania: *Marine fauna, chiefly.* Günther, A. 1869.3, 1872.3; Gunn, R. C. 1838.1; Hall, R. 1913.1; Hall, T. S. 1901.1; Johnston, R. M. 1883.1, 1884.2–1887.1, Add. 1884.1; Kent, W. S. 1886.1, Add. 1886.1–1887.2; McCulloch, A. R. 1907.1, 1911.1, 1914.1, 1916.2; Martin, M. 1834.1; Morton, A. 1893.1; Ogilby, J. D. 1893.2, 1895.7; Richardson, J. 1839.1, 1841.2, 1842.2; Waite, E. R. 1906.1; Ramsay, E. P. Add. 1881.1 — *Works of travel.* Meredith, C. Add. 1852.1; Meredith, L. A. Add. 1881.1.

Thursday I.: Vaillant, L. L. 1891.2; Weber, M. C. 1895.2.

HAWAIIAN ISLANDS

(**Sandwich Is.:**) *General treatises.* ★Gibert, C. H. 1905.1; ★Jordan, D. S., & Evermann, B. W. 1905.1 — *Various papers, chiefly marine fauna.* Abbott, C. C. 1861.1; Agassiz, J. L. 1858.4; Bryan, W. A. 1906.1; Evermann, B. W. 1902.10, 15; Fowler, H. W. 1901.1, 1903.2; Gilbert, C. H., & Cramer, F. 1897.1; Gill, T. N. 1863.3; Gray, J. E. 1831.2; Günther, A. 1873.1; Jenkins, O. P. 1895.1–1901.2, 1904.1; Jordan, D. S., & Dickerson, M. C. 1908.3; Jordan & Evermann, B. W. 1902.2, 1904.1, 2; Jordan & Metz, C. W. 1912.1; Jordan & Snyder, J. O. 1904.1, 1905.1, 1907.1; Jouan, H. 1873.1; Putnam, F. W. 1861.3; Seale, A. 1901.1; Snyder, J. O. 1904.1; Steindachner, F. 1901.1; Streets, T. H. 1878.1; Vaillant, L. L., & Sauvage, H. E. 1875.1 — *Works of travel.* Olmsted, F. A. 1841.1; Willemoes-Suhm, R. 1875.1.

[INDO-AUSTRALIAN ARCHIPELAGO

(**Dutch East Indies, East India Is., and Malay Archipelago.**)

General treatises

Atlas ichthyologique des Indes Orientales Néerlandaises. ★Bleeker, P. 1862.1 — *Catalogues, general treatises, etc.* Cantor, T. E. 1849.1; Latham, J., & Davies, H. 1795.1; Weber, M. C. 1890.1, 1901.2, 1909.1 — *The fishes of the Indo-Australian archipelago.* 3 vols. ★Weber, M., & Beaufort, L. F. 1911.1.

Zoögeography

Barbour, T. 1911.2; Beaufort, L. F. 1913.1.

Narratives of residence and travel

With references to the Indo-Australian fauna. Bélanger, C. 1834.1; Bickmore, A. S. 1868.1; Osbeck, P. 1765.1, 1771.2; Rosenberg, C. B. 1867.1; Ellis, W. Add. 1829.1, 1853.1; Forbes, H. O. Add. 1885.1 — *Accounts of early voyages to the East Indies, in Pre-Linn. section.* Dapper, O. 1670.1; Knox, R. 1681.1; Leguat, F. 1708.1; Linschoten, J. 1595.1; Mandelslo, J. A. 1658.1; Neck, J. C. 1600.1; Nieuhof, J. 1665.1–1686.1; Osbeck, P.

1757.1; Pyrard de Laval F. 1579.1; Ramusio, G. B. 1565.1; Renard, L. 1718.1; Schillinger, F. 1707.1; Tappe, D. 1704.1; Valentini, M. B. 1704.1.

Miscellaneous and general

Bedot, M. 1909.1; Bleeker, P. *Many refs. between 1849.1-1879.5*; Duncker, G. 1904.1; Franciscus, E. 1762.1; Harting, P. 1862.4; Popta, C. M. 1904.3; Sunier, A. L. 1914.1; Valenciennes, A. 1834.1.

Aru Is.: Bleeker, P. 1860.26, 1864.7, 1868.9, 1873.29 — *Fresh-water fauna*. Weber, M. C. 1907.2 — *Marine fauna*. Weber, M. C. 1911.1.

Babber I.: Weber, M. C., & Beaufort, L. F. 1912.3.

Banka I.: *Fresh-water fauna*. Bleeker, P. 1856.11 — *Marine fauna*. Bleeker, P. 1851.21, 1852.7, 18, 1853.10, 14, 1855.3, 1857.4, 1859.9, 29, 1860.15, 1861.3, 18; Bossche, J. F. 1862.1; Popta, C. M. 1902.2.

Bawean I.: Bleeker, P. 1859.1, 9.

Billiton I.: Bleeker, P. 1851.22, 1852.5, 1857.15, 1858.16, 1859.40, 1860.23.

Borneo: *Fresh-water fauna*. Bleeker, P. 1851.1, 5, 7, 19, 1853.21, 1855.1, 11, 1857.17, 1859.11, 16, 1860.38; Boulenger, G. A. 1893.1, 1895.5, 1899.6; Fowler, H. W. 1905.4; Hanitsch, R. 1900.1; Martens, E. 1864.3, 1868.1 (*Lake Danau Sriang*); Müller, S., & Schlegel, H. 1839.1; Perugia, A. 1892.1; Popta, C. M. 1902.1, 1905.1, 1908.1; Regan, C. T. 1906.4; Steindachner, F. 1903.1; ★Vaillant, L. L. 1889.3, 1891.1, 1893.1, 3, 1893.5, 1894.3, 1902.1, 1902.2 — *Relation to fauna of Celebes, with explanation of differences*. Popta, C. M. 1913.2. **Marine fauna, chiefly**. Bleeker, P. 1851.20, 23, 1852.21, 1859.18, 33, 36, 42, 1860.4; Bartlett, E. 1896.1; Günther, A. 1868.2; Gray, J. E. 1847.1; Jacquinet, H., & Guichenot, A. 1853.1; Károli, J. 1882.1; Low, H. 1848.1 (*List*); Radcliffe, L. 1913.2; Richardson, J. 1848.1; Reuvsen, C. L. 1895.3; Seale, A. 1910.2; Steindachner, F. 1903.1; Vinciguerra, D. 1879.1, 1889.1 — *Works of travel*. Beccari, O. Add. 1904.1; Nieuwenhuis, A. W. Add. 1900.1, 1904.1.

Celebes: *Fresh-water fauna*. Boulenger, G. A. 1897.1; Meyer, A. B. 1875.2; Popta, C. M. 1913.2; Weber, M. C. 1890.1, 1899.1, 1913.2. **Marine fauna, chiefly**. Agassiz, J. L. 1874.1; Bleeker, P. 1849.7, 1851.8, 1852.14, 1853.20, 1854.26, 1855.2, 24, 1856.2, 8, 1858.5, 12, 1859.17, 1860.5, 14, 20, 25, 41, Add. 1854.2; Günther, A. 1872.7; Meyer, A. B. 1885.1; Peters, W. C. 1865.2; Popta, C. M. 1912.2; Radcliffe, L. 1913.2; Smith, H. M., & Radcliffe, L. 1912.1 — *Work of travel*. Hickson, S. J. Add. 1889.1.

Christmas I.: Regan, C. T. 1909.5.

Flores I.: Bleeker, P. 1854.4, 1863.7; Reuvsen, C. L. 1895.2.

Java: *Fresh-water fauna*. Bleeker, P. 1861.16; Jordan, D. S., & Seale, A. 1907.3;

Reuvsen, C. L. 1895.1 (*Brantas R.*); Schlosser, J. A. 1764.1, 1777.1; Swieten, H. J. 1868.1. **Marine fauna, chiefly**. Bean, B. A., & Weed, A. C. 1912.1; Bleeker, P. 1844.1, 1846.1, 2, 1847.1-4, 1849.8, 1850.2, 1851.4, 6, 17, 1853.1, 8, 9, 17, 18, 1854.11, 13, 14, 23, 24, 1855.18, 1856.10, 1857.9, 10, 14-16, 1858.6, 7, 18, 1859.6, 14, 22, 25, 26, 34, 35, 37, 39, 44, 47, 1860.28, 35, 1861.11, 16, 1863.10, 1865.2; Hasselt, J. C. 1824.1, 2; Kampen, P. N. 1908.1, 1909.3, 1910.1; Károli, J. 1882.1; Kner, R. 1864.4, 1865.3; Martens, E. 1864.2; Oordt, J. 1766.1; Roosendaal, A. M. 1910.2; Thunberg, C. P. 1776.1; Weber, M. C. 1895.2; Anon. 86; Koningsberger, J. C. Add. 1911.1; Bontius, J. Pre-Linn. 1642.1.

Kei Is.: Bleeker, P. 1864.9, 1868.2; Weber, M. C. 1911.1.

Molucca or Spice Is.: *Chiefly marine fauna*. Hubrecht, A. A. 1876.2; Schlegel, H., & Müller, S. 1839.3; Steindachner, F. 1903.1 — *Amboina I., see below*. — *Banda Is.* Bleeker, P. 1851.2, 18, 1852.19, 1854.7, 8, 1856.12, 1859.8 — *Batjan I.* Bleeker, P. 1854.1, 1855.6, 15, 1856.14, 1857.20, 1859.27, 1860.7, 1862.8, 1863.19, 1868.12 — *Bouro I.* Bleeker, P. 1856.3, 1857.18, 1861.2, 1865.9 — *Ceram I.* Beaufort, L. F. 1912.1; Bleeker, P. 1852.6, 17, 1853.7, 1856.15, 1857.3, 1861.14, 1863.20, 1865.7 — *Gebi I.* Bleeker, P. 1868.13 — *Gilolo I.* Bleeker, P. 1853.15, 1854.3, 1855.17, 1863.33, 1867.3 — *Goram I.* Bleeker, P. 1858.2 — *Haruka I.* Bleeker, P. 1864.4, 1865.13, Add. 1866.1 — *Misol I.* Günther, A. 1872.10, 1873.8 — *Morotai I.* Bleeker, P. 1863.15 — *Nussalaut I.* Bleeker, P. 1864.8 — *Obi Major I.* Bleeker, P. 1855.5, 1863.8, 1868.18 — *Saparua I.* Bleeker, P. 1856.13, 1864.5 — *Ternatè I.* Bleeker, P. 1853.3, 15, 1854.9, 1855.13, 20, 1856.16, 1857.1, 1862.4, 1863.9, 17, 1868.11; Meyer, A. B. 1885.1; Römer, F. 1896.1 — *Wai-giu I.* Beaufort, L. F. 1912.1; Bleeker, P. 1868.6, 14. **Amboina I., Chiefly marine fauna**. Bleeker, P. 1852.6, 16, 1853.6, 19, 1854.25, 1855.23, 1856.1, 1857.2, 1858.10, 11, 1859.38, 1860.6, 17, 19, 33, 1863.32, 1865.3, 6, 1866.4, 1868.6, 8, 1869.3, 5, 1871.1, 1873.7, 13; Boddaert, P. 1782.1; Boddaert, P., & Schlosser, J. A. 1768.1; Hornstedt, C. F. 1788.1; Peters, W. C. 1876.4; Semon, R. W. 1902.1; Weber, M. C. 1895.2 — *Pre-Linn. references to fauna of Amboina*. Prévost, A. F. 1747.1; Rumpf, G. E. 1705.1; Ruysch, H. 1718.2; Valentijn, F. 1724.1.

Natuna Is.: Bleeker, P. 1854.27.

New Guinea or Papua: *See also Bismarck Archip. Fresh-water fauna*. Perugia, A. 1894.1; Regan, C. T. 1908.7, 1914.8, 10; Weber, M. C. 1906.1, 1910.3, 1913.3; Hase, A. Add. 1914.1; Ogilby, J. D. Add. 1890.1, 1891.1, 1898.1 — *Possible former connection of New Guinea and Australia*. Weber, M. C. 1907.3, 1908.1. **Marine fauna, chiefly**. Alleyne, H. G., & Macleay, W. M. 1877.1;

Fauna — Cont'd.

Bleeker, P. 1859.2, 1861.13, 1868.17, 1877.13, 1878.3, 1880.1; Boulenger, G. A. 1903.2; Jacquinet, H., & Guichenot, A. 1853.1; Macleay, W. 1877.2, 1883.1, 1884.2, Add. 1882.1, 2; Meyer, A. B. 1885.1; Ogilby, J. D., & McCulloch, A. R. 1916.1; Peters, W. C. 1876.4; Ramsay, E. P., & Ogilby, J. D. 1886.1; Regan, C. T. 1914.8; Weber, M. C. 1895.2, 1908.2 — *Works of travel and residence with incidental references.* Sonnerat, P. 1775.1, 1776.1, 1777.1; Albertis, L. M. Add. 1881.1; Clercq, F. S., & Schmeltz, J. Add. 1893.1; Forrest, T. Add. 1779.1; Krieger, M. Add. 1899.1.

Nias I.: Bleeker, P. 1856.4; Perugia, A. 1889.1.

Riou Linga Archip.: *Bintang I.* Bleeker, P. 1856.9, 1860.24, 1868.16 — *Riou I.* Bleeker, P. 1851.3, 1859.32.

Sangir Is.: Bleeker, P. 1857.5, 1868.10 — *Vernacular names.* Van Doren, J. B. Add. 1858.1.

Singapore I.: *Fresh-water fauna.* Bleeker, P. 1860.37; Castelnau, F. L. 1860.2 — *Marine fauna, chiefly.* Bedford, F. P. 1900.1; Bleeker, P. 1851.25, 1852.8, 1858.13, 1860.3, 9, 32, 37, 1861.6, 12, 1877.13; Filippi, F. 1867.1; Károli, J. 1882.1; Kner, R. 1864.4, 1865.3; Lütken, C. F. 1874.1; Steindachner, F. 1870.1; M'Clelland, J. Add. 1842.2.

Sulu Is.: see under Philippine Is.

Sumatra: *Catalogue.* ★Volz, W. 1907.1 — *Fresh-water fauna.* Bleeker, P. 1859.5, 6, 24; Boulenger, G. A. 1890.5; Volz, W. 1903.1, 1904.1, 2; Weber, M. C., & Beaufort, L. F. 1912.2; Hubrecht, A. A. Add. 1886.1 *Marine fauna, chiefly.* Bleeker, P. 1852.15, 1853.9, 16, 17, 1854.22, 1855.10, 22, 1858.1, 1859.5, 6, 13, 21, 23, 24, 30, 31, 1860.1, 8, 30, 34, 1861.8; Brauer, A. 1902.1; ★Fowler, H. W. 1904.1; Park, M. 1797.1; Perugia, A. 1889.1, 1893.1; Vinciguerra, D. 1879.1; Volz, W. 1903.1, 1904.1, 2.

Sunda Is.: See also Java, and Sumatra. Schlegel, H., & Müller, S. 1839.3 — *Bali I.* Bleeker, P. 1849.2, 1857.12, 1859.4, 1860.22, 1861.10 — *Batu Is.* Bleeker, P. 1855.4, 16, 1857.8 — *Engano I.* Perugia, A. 1893.2 — *Kokos I.* Bleeker, P. 1854.21 — *Lombok I.* Popta, C. M. 1911.2, 1912.4 — *Madura I.* Bleeker, P. 1849.3 — *Mentawi Is.* Perugia, A. 1896.2 — *Rotti I.* Bleeker, P. 1863.24; Reuvsen, C. L. 1895.2 — *Sandalwood (Sumba), and Semaos Is.* Reuvsen, C. L. 1895.2 — *Solor I.* Bleeker, P. 1851.24, 1852.20, 1853.2, 1854.10, 1868.1, Add. 1854.1 — *Sumbawa I.* Bleeker, P. 1848.1, 1855.12, Add. 1859.1.

Timor I.: Bleeker, P. 1852.9, 1854.18, 1857.20, 1860.18, 1861.15, 1863.21; Reuvsen, C. L. 1895.2; Weber, M. C., & Beaufort, L. F. 1912.3.

Woodlark or Moiou I.: Montrouzier, X. 1856.1–1857.1; Thiollière, V. J. 1856.1

MELANESIA

Bismarck Archip.: *Neu Pommern. (New Britain)* De Vis, C. W. 1884.2; Günther, A. 1877.5 — *New Hanover.* Peters, W. C. 1876.4 — *New Mecklenburg, (New Ireland)* Günther, A. 1877.5; Peters, W. C. 1876.4.

New Caledonia: Forster, J. R. 1844.1; Garnier, J. 1903.1; Jouan, H. 1861.1, 1878.1; Ogilby, J. D. 1898.1; Weber, M. C., & Beaufort, L. F. 1913.1.

New Hebrides: De Vis, C. W. 1884.2; Pellegrin, J. 1912.15; Regan, C. T. 1904.1; Seale, A. 1906.1.

Solomon Is.: Macleay, W. 1880.1; Ogilby, J. D. 1890.5; Seale, A. 1906.1.

MICRONESIA

Caroline Is.: Fowler, H. W. 1900.4, 1902.2; Jacquinet, H., & Guichenot, A. 1853.1; Kittlitz, F. H. 1858.1; Vaillant, L. L. 1893.6 — *Work of travel.* Christian, F. W. Add. 1899.1.

Johnston I.: Smith, R., & Swain, J. 1882.1.

Marcus I.: List. Bryan, W. A. 1903.1.

Mariana or Ladrone Is.: Kendall, W. C., & Goldsborough, E. L. 1911.1; Kittlitz, F. H. 1858.1; Pellegrin, J. 1898.1 — *Guam I.* Seale, A. 1903.1.

Marshall Is.: Kittlitz, F. H. 1858.1; Schnee, S. 1903.1; Garman, S. Add. 1888.1 — *Work of travel.* Erdland, P. A. Add. 1914.1.

POLYNESIA

Cook Is.: Kendall, W. C., & Goldsborough, E. L. 1911.1 — *Rarotonga.* Seale, A. 1906.1 — *Aitutaki I. (Sport)* Anon. 280.

Easter I. Kendall, W., & Radcliffe, L. 1912.1; Regan, C. T. 1913.3.

Ellice Is.: *Funafuti.* Waite, E. R. 1897.1, 1899.1.

Fanning Is.: Streets, T. H. 1878.1.

Fiji Is.: Boulenger, G. A. 1897.7 (*Rotumah*); Garman, S. 1903.1; Jacquinet, H., & Guichenot, A. 1853.1; Jordan, D. S., & Dickerson, M. C. 1908.3; Peters, W. C. 1876.4 — *Viti Levu.* Macdonald, J. D. 1869.1; Steindachner, F., & Kner, R. 1870.1.

Gilbert Is.: Kittlitz, F. H. 1858.1; Krämer, A. 1901.1; Waite, E. R. 1903.3.

Low Archip. or Paumotu Is.: *Mangareva Is.* Kendall, W. C., & Radcliffe, L. 1912.1 — *Makatea.* Seale, A. 1906.1 — *Marutea and Rikitea.* Vaillant, L. L. 1887.2 — *King's I. (Fresh-water)* Johnston, R. M. Add. 1887.1.

Marquesas Is.: *Nukahiva.* Seale, A. 1906.1 — *Works of travel.* Christian, F. W. Add. 1910.1; Coulter, J. Add. 1845.1.

Samoan Is.: *General treatise.* ★Jordan, D. S. & Seale, A. 1906.2 — *Various papers, chiefly marine fauna.* Evermann,

B. W. 1902.7; Fowler, H. W. 1901.1; Jordan, D. S. 1902.7; Kendall, W. C., & Radcliffe, L. 1912.1; Steindachner, F. 1901.1, 1906.4; Streets, T. H. 1878.1.

Society Is.: *Marine fauna, chiefly.* Günther, A. 1873.1; Kendall, W. C., & Goldsborough, E. L. 1911.1; Olmsted, F. A. 1841.1 — *Raiatea*. Seale, A. 1906.1 — *Tahiti*. Banks, Joseph. 1896.1; Jenyns, L. 1842.1; Jordan, D. S., & Snyder, J. O. 1905.2; Seale, A. 1906.1; Vaillant, L. L. 1887.2.

Suvarof I.: Stead, D. G. 1907.4.

Tonga Is.: (*Friendly Is.*) Kendall, W. C., & Goldsborough, E. L. 1911.1.

Tubuai or Austral Is.: Seale, A. 1906.1.

NEW ZEALAND

General treatises

Catalogues. ★Gill, T. N. 1893.1; ★Hutton, F. W., & Hector, J. 1872.1 — *Lists.* Hutton, F. W. 1890.1, 1904.2; Kirk, T. W. 1880.1; Richardson, J. 1843.3; ★Waite, E. R. 1907.1, 1912.1 — *Bibliography.* Hamilton, A. 1902.1 — *Handbook.* Sherrin, R. A. 1886.1 — *Work of travel.* Chilton, C. Add. 1909.1.

Fresh-water fauna: Clarke, F. E. 1899.1; Gray, J. E. 1842.1, 1843.1; Günther, A. 1867.7; Haast, J. F. 1874.1; Hector, J. 1871.2; Mair, G. 1903.1 (*Piako R.*); Powell, L. 1870.1 (*River Avon*); Vollams, S. E. 1873.1 — *Whanganui R.* Mair, Add. 1880.1.

Marine fauna: Anderton, T. 1907.1; Arthur, W. 1883.1–1884.2; Benham, W. B. 1901.1–1903.1; Bleeker, P. 1855.14; Cheeseman, T. F. 1891.1; Clarke, F. E. 1878.1–1899.3; Colenso, W. 1878.1; Forbes, H. O. 1892.1; George, S. 1881.1; Günther, A. 1877.7, 1887.3; Günther, A., & Hector, J. 1867.1; Haast, J. F. 1873.1–1878.1; Hamilton, A. 1902.3, Add. 1896.1; Hector, J. 1869.1–1903.1, Add. 1872.1; Hutton, F. W. 1872.1–1904.3, Add. 1879.1; Jenyns, L. 1842.1; Knox, F. J. 1870.1–1873.1; Kyle, H. M. 1901.1; Parker, T. J. 1884.4, 1894.1; Richardson, J. 1842.5, 1845.2; Thomson, G. M. 1892.1; Waite, E. R. 1899.2, 1910.2, 1911.2, 4, 1912.2, 1913.2, 3, 4 — *Mokohinou Is.* Sandager, F. S. Add. 1888.1 — *Subantarctic islands.* Waite, E. R. 1909.2.

North I.: (*Marine fauna*) *Taranaki coast.* Clarke, F. E. 1898.1 — *North Cape.* Regan, C. T. 1914.1, 4 — *Wellington.* Rutland, J. 1896.1.

South or Middle I.: (*Marine fauna*) *Dunedin.* Parker, T. J. 1884.3; Thomson, P. 1877.1, 1879.1; Webb, J. S. 1873.1 — *Hawkes Bay, Napier.* H., A. 1883.1; Hamilton, A. 1886.1 — *Hokitika.* Campbell, W. D. 1879.1; Clarke, F. E. 1879.1 — *Moeraki.* Parker, T. J. 1884.2, 1887.2 — *Nelson Harbor.* Hector, J. 1882.1; Kingsley, R. I. 1889.1 — *Otago.* Thomson, G. M. 1913.1 — *Poverty Bay.* Williams, W. L. 1893.1.

Campbell I.: Sauvage, H. E. 1880.6.

Kermadec Is.: *List and comparison with Lord Howe I.* Waite, E. R. 1910.1, 1911.1.

PHILIPPINE ISLANDS

Catalogue. Casto de Elera, F. 1895.1 — *Check-list.* ★Jordan, D. S., & Richardson, R. E. 1910.1 — *Fresh-water fauna.* Boulenger, G. A. 1895.7; Peters, W. C. 1868.3; Smith, H. M. 1902.8 (*Lake Buhì*); Wood, W. W. 1876.1 — *Lake Manquae, Palawan.* Day, A. L. Add. 1914.2. **Marine fauna.** Bleeker, P. 1865.12; Cartier, O. 1874.1; Evermann, B. W. 1907.4; Evermann, & Seale, A. 1906.1, 1907.1; Gentil, W. 1781.1; Gorgoza y Gonzalez, J. 1885.1, 1888.1; Günther, A. 1872.6; Jordan, D. S., & Richardson, R. E. 1908.1; Jordan, & Seale, A. 1905.1, 1907.1; Kner, R. 1864.4, 1865.3; Marion de Procé, — 1822.1; Meyer, A. B. 1885.1; Pickering, C. 1865.1; Radcliffe, L. 1912.1, 2, 1913.1, 2; Seale, A. 1909.1, 1910.1, 1912.1; Seale, A., & Bean, B. A. 1907.1; Smith, H. M. 1911.3, 1912.2, 3, 4, 6, 1913.1; Smith, H. M., & Radcliffe, L. 1911.1; Smith, H. M., & Seale, A. 1906.1 — *Pre-Linn. ref.* Kamel, G. J. 1706.1.

FINS (LIMBS OF FISHES)

Many of the papers cited here include the musculature of the fins. Other papers more specifically relating to musculature will be found below *Limb and trunk muscles under Myology.*

For the structure of the limb girdles, *see under Pectoral girdle, and Pelvic girdle.*

For the renewal of the dermal rays and the fin-membranes after their removal, *see under Regeneration.*

For all references to abnormalities in the structure of fins, such as the absence in some individuals of certain fins, or the presence of extra, accessory, or supernumerary fins, *see below Abnormalities of fins under Teratology.*

For the functions of the fins, *see under Locomotion.*

Morphologically, the limbs of fishes may be divided into the median and the paired fins.

SUPPORTING ELEMENTS

Endoskeletal fin-supports

Both the median and paired fins are supported by an internal skeleton composed of cartilaginous or bony *endoskeletal* pieces, the radial elements (or pterygiophores of Parker, T. J. 1886.3, p. 24). These provide supports for the *exoskeletal* dermal fin-rays which are described below.

The essential distinction between the endoskeletal fin-supports and the secondary exoskeletal dermal rays was first brought out by Bruch (C. W. 1861.1).

In the Cyclostomata, presumably representing the primitive condition, the radial elements are unsegmented outgrowths from the dorsal and ventral vertebral arches, i. e. extensions of the neural and hæmal spines. In the Dipnoi, the mesial supporting elements are also prolonged neural and hæmal spines, each being subdivided into three segments. Likewise in Pleuracanthus, according to Woodward (A. S. 1892.3), the identity in origin of the endoskeletal fin-supports and the processes of the vertebræ is well shown.

Fins — Cont'd.

In Cladoselache, a primitive Elasmobranch, the radial elements have become divided into a basal and a distal segment (Dean, B. 1894.1). In existing Elasmobranchs, the elements are generally trisegmental. While generally trisegmental in the Teleostomes, they here exhibit a tendency toward reduction, and their original relations to the vertebral arches are obscured. They are, in Teleosts, generally called "inter-spinous bones" (interneural or interhæmal elements).

The series of endoskeletal fin-supports, following the arrangement of Bridge (p. 533), may be termed *radial elements*. They may be further subdivided into *proximal* (basal or innermost), *mesial*, and *distal segments*. When bisegmental, the terms "basal" and "radial" (Dean, B. 1895.4, p. 32) have often been employed. The terms of Cope (E. D. 1890.1, p. 414); *axonost* equivalent to "proximal", and *baseost*, supporting the dermal fin-rays, and equivalent to "mesial" or "distal," although adopted by Woodward (A. S. 1889.2, vol. ii, p. 321) seem unnecessary.

The most valuable summary of this subject (in *Ganoids and Teleosts*), is ★Bridge, T. W. 1896.1.

In Elasmobranchs, Mivart termed these elements "radials" (further subdivided into basal or innermost, median, and distal cartilages). Excellent descriptions with figures of numerous species are given in Mivart, St. G. 1879.1.

Thacher (p. 292), noting that the fin-supports of Dipnoi are elongated neural spines, believed that this condition, instead of being primitive, was due to the loss of the "primordial median fin-rays" (radials). Thacher, J. K. 1876.1.

Development of dermal fin-rays

The following remarks present a summary of Goodrich, E. S. 1904.1.

In all of the fins of the true Pisces, there are dermal (*exoskeletal*) rays of mesoblastic origin, the *dermotrichia*. In Amphioxus and the Cyclostomata, however, true dermal rays are not developed. The ray-like structures which have been described in the larva of Amphioxus are merely elongated epidermal cells. The delicate cartilaginous rays supporting the fins of Cyclostomes are endoskeletal, being prolongations of the neural and hæmal arches.

In the Elasmobranchii and Holocephali, probably also the Acanthodii and Ichthyotomi, there is a single type of dermal ray, the *ceratotrichia* (Goodrich's term, p. 469), known also as "Hornfäden" or "Elastoidinfäden" by German authors. These fibrous, flexible, *horny* rays are never ossified nor jointed, but may be branched. The fibrils are secreted by the mesoblastic scleroblasts. Sections of the fin may show several layers of ceratotrichia on either side. The dermal or placoid (shagreen) denticles are quite independent of these rays and are more superficial in position, generally concealing them from view.

In the Teleostomes, occur two types of dermal rays. The first of these, slender, unjointed, *horny* fin-rays, essentially like and possibly identical with the ceratotrichia, were first noted in the adipose fin of Salmonidæ by La Valette St. George (A. J. 1880.2). By Ryder (J. A. 1885.6, p. 157) they were named *actinotrichia*. They are the earliest rays in the embryonic fins, being later functionally replaced by the following type, except in the adipose fin and in the growing fin-edges, where they persist. The definitive *bony* fin-rays, typically ossified,

jointed, and branched, are termed *lepidotrichia* by Goodrich, p. 472. The essential resemblance of these rays to the body-scales was noted by Baudelot (E. 1873.3), and this homology was clearly established by Hertwig (O. 1876.1). A perfect transition between the scales and the joints of the lepidotrichia in the fossil Amblypterus is shown by Goodrich (fig. 55). Formed bilaterally, and later fused, each dermal ray is double. Each ray articulates with the extremity of one endoskeletal fin support (radial element) in the higher Teleostomes, but in the lower Teleostomes and Dipnoi the dermal rays are more numerous.

In the Dipnoi, there are jointed, branched, dermal rays, containing bone-cells, which Goodrich (p. 513) calls *camptotrichia*. These seem to be in a degenerate condition and may represent the lepidotrichia of the Teleostomes. As in certain Teleosts, scales may extend over the greater part of the fins, and thus secondarily overlies the dermal rays.

As above indicated, the most valuable paper on this subject is ★Goodrich, E. S. 1904.1.

Scholarly treatises on the development of the *horny* rays of Elasmobranchs and the *bony* rays of Teleosts are cited under ★Harrison, R. G. 1893.1–1895.2.

Development or structure of the fin-rays in various fishes. ★Brohl, E. 1909.1; Hancock, J. 1830.2; ★Ryder, J. A. 1879.1, 1887.5, 1890.1; Szily, A. 1907.1; Vaillant, L. L. 1896.5; Ziegler, H. E. 1908.3.

"Very thin, structureless" fin-rays in the adipose fin (of *Osmerus*) were first noted in a brief remark by Gulliver, G. 1872.2.

The distinction between fin-rays as exoskeletal from other bones as endoskeletal breaks down on embryological grounds, since both are of mesoblastic origin, according to Ryder, J. A. 1885.2.

Relation of temperature to the number of fin-rays in *Pleuronectidæ* (reduction in warmer climates). Cox, P. Add. 1903.1.

Development of fin spines

In Elasmobranchs the secondary clustering of the dermal denticles or cusps on the exposed anterior fin margins (Dean, B. 1895.4, p. 28) has produced rigid spines or dermal defenses.

In Teleostomes the development of bony tissue in the anterior dermal fin rays also produces stout spines. While the soft dermal rays exist in all Teleostomes, spines, followed by soft rays, occur only in more specialized forms, which form the old order of *Acanthopterygii*.

Structure and development of the spines in Elasmobranchs. Hannover, A. 1868.1; ★Koppen, H. 1901.1; Meyer, G. H. 1847.1; ★Markert, F. 1896.1; ★Ritter, P. 1900.1.

Structure or development in the following Teleosts. — *Siluridæ*. Bliss, R. 1875.1. — *Gasterosteus*. Ryder, J. A. 1885.3. — *Synodontis*. Vaillant, L. L. 1895.2, 1898.2.

Articulation of spines in Teleosts, including the trigger mechanism for locking the spines and the musculature for their erection. Bliss, R. (*Balistes*) 1872.2; Dönitz, F. K. (*Teuthis*) 1866.1, 1867.2; Hilgendorf, F. M. (*Monocentris*) 1879.3; Mayer, A. F. 1862.1; Sørensen, W. E. 1884.1, 1897.1; ★Thilo, O. 1879.1–1898.1, .3, 1901.1, Add. 1899.1–1910.1.

Numerous species of Teleosts have a "Poison apparatus composed of spines and associated glands." For references, see below this caption under Poisonous fishes.

Ichthyodorulites. Numerous isolated spines, found in the Devonian and Carboniferous strata, are considered to be the dorsal spines of Elasmobranchs. They constitute the sole remains of these fishes. Their nature was first recognized by Buckland and De la Beche who used the term "ichthyodorulites." By Woodward (p. 92), this term is restricted to those spines, tubercles, and plates exhibiting the microscopical structure of vascular dentine. Numerous genera have been proposed for these isolated spines.

Full bibliographic references to all genera will be found in Woodward's "Catalogue" (Woodward, A. S. 1889.2, vol. ii, p. 92 *et seq.*) and (American forms) in Hay, O. P. 1902.1, p. 326.

MEDIAN FINS

Including the dorsal, caudal, and anal fins. The median fins are believed to be of greater antiquity than the paired fins. In embryo fishes, a continuous median fringe appears long before the origin of the paired fins. In the lower groups, Cephalochordata and Cyclostomata, the median fins are the only existing fins, although this condition may be due to the loss of the paired fins through degeneration.

The median fins are considered to be the discontinuous remnants of a primitively continuous median fringe.

A valuable work in German, especially on the embryological development of the median fins, is ★Schmalhausen, J. J. 1912.1.

See also ★Goodrich, E. S. 1906.1, who showed that the median fins in Elasmobranchs develop essentially like the paired fins.

Through artificial breeding, the Japanese have produced numerous modifications in the median fins of goldfish; there are double-tailed varieties, split or double anal fins, etc., etc. See Bade, E. 1905.2; Matsubara, S. 1908.1; Pouchet, G. 1870.1; ★Smith, H. M. 1909.2; ★Storch, O. 1911.1; and Watase, S. 1887.1.

In *Echeneis* and *Remora*, the dorsal fin has become greatly modified to form an Adhesive disk, which see.

Morphology and development of median fins chiefly the caudal fin or tail

Most of the following references, except as otherwise stated, treat of the morphological nature of the termination of the vertebral column in the tail. This work has been in gradual expansion and more precise definition of the original conception of Agassiz (J. L. 1833.2), who on the grounds of external symmetry recognized two types of caudal fin, the asymmetrical "heterocercal" and the symmetrical "homocercal" types.

The most recent and valuable summaries of this subject, from which most of the information given below has been gleaned, are those cited under ★Whitehouse, R. H. 1910.1 and 1910.2.

An older but valuable, complete discussion of the subject is ★Ryder, J. A. 1886.8.

Other papers with further delimitations and refinements in terminology are ★Dollo, L. 1896.2 and ★Gregory, W. K. 1907.1.

Hippocampus lacking a caudal fin uses tail as a prehensile organ. Dufossé, A. 1874.2.

TYPES OF CAUDAL FINS

Protocercy. All fishes first possess a protocercal tail in the embryonic condition, and it seems safe to infer that this is the true primitive condition, from which the more specialized types have evolved. A protocercal fin may be defined as one which is *primitively symmetrical*, externally and internally, having not undergone any reduction or modification of the original form. The chorda ends in a perfectly straight line and the supports of the fin-rays are equal in number and kind, both dorsally and ventrally, so that the dorsal and ventral fin-rays contributing to the caudal fin are likewise equal in number and position. The term "protocercal" was first used by Wyman (J. 1864.2) to designate the median fin-fold condition of the tail of the larval *Raja*. Agassiz (A. 1878.1, I, p. 123) proposed the term *leptocardial* which is now considered synonymous with the preceding.

Another type of caudal fin, also perfectly symmetrical both internally and externally, which however is *secondarily symmetrical*, is the *gephyrocercal* type defined below.

M'Coy (Sir F. 1848.2, p. 304) first used the term *diphycercal* to designate the *symmetrical* caudal fin of *Diplopterus*. Cope (E. D. 1871.1, p. 452) in ignorance of this term, coined *isocercal* for the symmetrical caudal. The term "diphycercal" originally used with no qualification regarding primitive or secondary symmetry, may, for all practical purposes, be dismissed, in the view of Whitehouse, who would however retain it "as applying to a caudal fin which it may not be wise or possible to refer to as protocercal or gephyrocercal."

"It is probably correct to say that no true fishes possess a protocercal fin in the adult condition; the Cyclostomes are generally credited with having protocercal tails, but it is likely that even here a degenerate condition is present." Whitehouse, R. H. 1910.1, p. 135.

Median fins of Cyclostomata

For the caudal skeleton in *Myxine* and *Petromyzon*, see ★Ayers, H. & Jackson, C. M. 1900.1; Cleland, J. 1886.1; Retzius, M. G. 1892.1, 1895.2; ★Schaffer, J. 1901.1, 2.

The "pre-anal fin" of *Myxine* is a skin fold, according to Lönnberg, A. J. 1902.7.

Heterocercy. "A heterocercal caudal fin may be defined as one in which the extremity of the chorda is directed upwards, and as a consequence is *unsymmetrical* externally and internally, the ventral lobe being greater than the dorsal; and, moreover—and this is a most important feature, to which I have not seen attention drawn—when centra are formed, these elements remain distinct to the end of the axis." Whitehouse, R. H. 1910.1, p. 136.

Heterocercy in Elasmobranchii

Chiefly, development and morphology of the tail in *Selachians*. Ahlborn, C. G., 1895.2; Beneden, P. J. 1853.1, 1861.1; ★Dohrn, A. 1882.2 (vi); Garman, S. (*Chlamydoselachus*) 1887.1; Haswell, W. A. 1885.2; Helbing, H. 1902.1, 1904.1; ★Mayer, P. 1886.1; Virchow, H. 1895.3; ★Schmalhausen, J. Add. 1913.1.

Fins — Cont'd.

Excellent plates of the skeleton of the median fins of many Selachians appear in ★Mivart, St. G. 1879.1.

Heterocercy in Teleostomi

"In *Acipenser* the typical heterocercal form . . . is present; *Polydon* by an increase in the size of the ventral lobe reaches a step towards the externally symmetrical homocercal fin; while *Amia* proceeds furthest of all in the homocercal direction, requiring but one single feature, the possession of a true urostyle, to attain the homocercal condition." Whitehouse, R. H. 1910.2 (p. 595, 596).

Development of median fins, especially the dorsal fin, in Acipenser. Dikson, B. 1912.1; ★Zalenskii, V. V. 1899.1; Zograf, N. Y. 1887.3; Schmalhausen, J. J. Add. 1913.1.

Development of tail, respectively in Lepidosteus and Amia. Wilder, B. G. 1876.2, 1877.6.

General accounts of the tail of Teleostomes, including Ganoids, are Heckel, J. J. 1850.3, and Kölliker, R. A. Add. 1860.1.

Homocercy. With the possible exception of the forms mentioned below under "gephyrocercy," this form of caudal is found in all Teleostei. It may be considered a specialized form of the heterocercal type. The term "homocercal" is very broad in application. By Whitehouse (R. H. 1910.1, p. 138), it is defined as "a caudal fin which is externally symmetrical but in which the majority of the fin-rays are supported internally by hypaxial [ventral] elements, and in which a urostyle is present either in the adult or at some time during larval history."

The most comprehensive account of the morphology of the tail in Teleostei is ★Whitehouse, R. H. 1910.2.

Huxley (T. H. 1859.1) says that "the first accurate and comprehensive account of the structure of the piscine tail," is ★Heckel, J. J. 1850.3.

Other papers on the morphology or development of the caudal in Teleosts, are ★Agassiz, A. 1878.1; Baudelot, E. 1868.2; Costa, A. 1869.1; ★Huxley, T. H. 1859.1; ★Lotz, T. 1864.1; Peach, C. W. 1859.2; Regan, C. T. 1910.2, .5; ★Ryder, J. A. 1885.11, .14, 1886.8; Sauvage, H. E. 1872.1; Schmidt, V. 1893.1; Steenstrup, J. J. 1866.1; ★Totton, A. K. (*Pleuragramma*) 1914.1; ★Kölliker, R. A. Add. 1860.1; Newton, E. T. Add. 1882.1.

Gephyrocercy. The *gephyrocercal* caudal is a secondary one, the original caudal being aborted or lost during larval (Mola) or post-larval existence (Fierasfer), and the secondary fin formed by the union of the rays of the dorsal and ventral median fins, around the abbreviated extremity. It is perfectly symmetrical, both externally and internally. The term "secondary diphyrcy," as above stated, is synonymous with this term.

As stated in the original definition (Ryder, J. A. 1886.8, p. 991), among Teleosts, this type of caudal occurs only in the two forms, Mola and Fierasfer.

Certain fossil forms of *Cœlacanthidæ* (*Crossopterygii*), such as *Undina*, possess a *gephyrocercal* caudal fin (Reis, O. M. 1888.1, 1892.3).

Gephyrocercy in Dipnoi

"It is highly probable that this group will be found to afford the best examples of the *gephyrocercal* form." Whitehouse, R. H. 1910.1, p. 142.

"Diphyrcy in its existing conditions, . . . as in *Ceratodus*, is, . . . a specialized, perhaps more strictly a degenerate condition, directly comparable with *gephyrocercy*." Dean, B. 1894.1, p. 102.

Dollo (L. 1896.2) in the "*phylogénie des dipneustes*" has erred in too extensive an application of the term "*gephyrocercy*," in the belief of Whitehouse.

PAIRED FINS

Including the pectoral, and the pelvic or ventral fins. The following references are arranged primarily with regard to the anatomical structure in the different groups. However, most of such researches have been inspired by the views of the derivation or origin of the paired fins. The latter topic forms a separate subject and the chief hypotheses on the origin of the limbs are discussed below "*Phylogenesis of limbs*" under Evolution.

The hypothesis of the origin of the paired fins from a continuous lateral fin-fold, like that of the median fins, is now the most prevalent view. It was the independent observation by both Mivart and Thacher, of the resemblance between the median and paired fin-structures in *Raja*, which led each separately to form his conception of the identity in origin of the median and paired fins (Mivart, St. G. 1879.1, p. 467).

General treatises

Valuable general treatises in German, treating of the development and structure of the paired fins in all groups, are ★Braus, H. 1904.2, 1906.1; ★Davidoff, M. 1879.1; ★Gegenbaur, C. 1864.2 (ii); and ★Wiedersheim, R. 1892.1.

Valuable treatises in English, especially reviewing the origin of the paired fins, are ★Goodrich, E. S. 1906.1 and ★Mivart, St. G. 1879.1.

Various miscellaneous or unclassified papers on the paired fins are Geoffroy-Saint-Hilaire, E. F. 1807.3, .4, .7, 1818.2, .4; Gouriet, E. 1868.1; Hartwig, P. 1870.1; Hatschek, B. 1889.1; ★Kner, R. 1860.2; Lavocat, A. 1896.1; Mettenheimer, C. F. 1847.1.

Paired fins in the various groups**Fins of Dipnoi**

Gegenbaur (C. 1870.4) originally adopted the *Lepidosiren* type of limb as the ancestral form of the *Elasmobranch* fin. He later (1873.1) adopted the *Ceratodus* type as the archipterygium or the fundamental form of the vertebrate limb. This view was accepted by Günther (A. C. 1871.4) and by Huxley (T. H. 1876.1).

A contrary view was formulated by Mivart (St. G. 1879.1, p. 473) who says "the fin of *Ceratodus* cannot represent the archipterygium, and, far from being a primitive form . . . is, on the contrary, a very special and peculiar structure, which is carried to a still more abnormal development in *Lepidosiren*, by progressive elongation and by atrophy of the post-axial radials."

Howes (G. B. 1887.1, p. 24) believes "that the paired fins of *Plagiostomes* and *Dipnoi* have, in all probability, arisen independently

from a type of fin most nearly represented by that of the living chimæroids."

Embryological development of paired fins in — Lepidosiren and Protopterus. Agar, W. E. 1907.1. — *Ceratodus (Neoceratodus)* ★Semon, R. W. 1898.1, 1899.3.

Musculature and innervation of the fins of Ceratodus. Braus, H. 1898.1, 1900.1.

Skeleton of the paired fins, chiefly of Ceratodus. ★Davidoff, M. 1879.1; Haswell, W. A. 1883.2; ★Howes, G. B. 1887.1; Sabatier, C. P. 1904.1; Schneider, A. F. 1886.1, 1887.1; Vanhöffen, E. 1890.1.

Fins of Elasmobranchii

As described by Balfour (F. M. 1881.1, p. 663), the skeleton of the pectoral fin of Elasmobranchs "consists of three basal pieces [radials] articulating with the pectoral girdle; on the outer side of which there is a series of more or less segmented cartilaginous fin-rays [also radials]. Of the basal cartilages one is anterior [external], a second is placed in the middle, and a third is posterior [internal]. They have been named by Gegenbaur the *propterygium*, the *mesopterygium*, and the *metapterygium*; and these names are now generally adopted."

Embryological development of the paired fins in Selachii, including the development of the skeleton. Balfour, F. M. 1881.1; Braus, H. 1906.2; Dohrn, A. 1882.2 (vi); Goodrich, E. S. 1906.1; Ruge, E. (*Spinax*) 1902.1; Mollier, S. Add. 1892.1.

Musculature, innervation, etc., of the paired fins. ★Braus, H. 1898.1, 2, 1899.1, 1906.2; ★Backman, G. 1913.1; ★Müller, E. 1909.1, 1911.1.

Structure and arrangement of the skeletal elements of the paired fins. Gegenbaur, C. 1870.4; ★Haswell, W. A. 1885.2; Helbing, H. 1902.1, 1904.1; Howes, G. B. 1890.1; ★Mivart, St. G. 1878.1, 1879.1; Prince, E. E. & MacKay, A. H. (*Lamna*) 1901.1; Sabatier, C. P. 1898.1, 1904.1.

Pectoral fin skeleton in various fossil sharks. Braus, H. 1902.1; Fritsch, A. J. (*Pleuracanthus*) 1888.2–1891.1.

See also Phylogenesis of Limbs under Evolution.

Numerous examples have been recorded of abnormal rays or skates in which the pectorals are not adherent to the head. This teratological form was described as the new genus *Propterygia*, by Otto (A. W. 1821.2). For these references, see under Teratology.

For the appendages of the pelvic fins of male Elasmobranchs (*Myxopterygia*), see Copulatory organs below Viviparity under Reproduction.

Fins of Teleostomi

Crossopterygii

Skeleton of the paired fins of Crossopterygii. Emery, C. 1897.3; ★Gegenbaur, C. 1895.2; ★Klaatsch, H. 1896.1.

Variation in skeleton of pectoral, in Polypterus. Bamford, E. E. 1913.1.

Pelvic fin of Eusthenopteron. Goodrich, E. S. 1901.1. — *Pectoral of Cælacanthus.* Wellburn, E. D. 1901.4.

Chondrostei and Holostei

Development of skeleton of pectoral fins in Amia. Heronimus, C. 1911.1.

Embryological development of paired fins in Acipenser. ★Mollier, S. 1893.1.

Figures of the skeleton of the pelvic fin — Acipenser, Polydon, and Scaphirhynchus. Rautenfeld, E. 1882.1. — *Polydon.* Thacher, J. K. 1877.1.

Teleostei

Embryological development of the paired fins in Teleosts, chiefly the trout or salmon, including the development of the fin skeleton and the girdles. ★Boyer, E. R. 1892.1; Corning, H. K. 1894.1; Derjugin, K. M. 1908.1–1912.1; Ducret, E. 1893.1, 1894.1; ★Harrison, R. G. 1894.1, 1895.2; Oelacher, J. 1872.1, 1879.1; Prince, E. E. 1886.3, 1890.2; Swinnerton, H. H. 1905.1, 2; Swirski, G. (*Esox*) 1880.1; ★Vogel, R. 1909.1.

Development of the large pectorals in the flying-fish, Exocætus. Derjugin, K. M. 1908.1; Derjugin, K. & Rozhdestvensky, E. 1912.1.

The larval Symbranchus, for a while, has large pectorals which later disappear. Derjugin, K. M. 1912.1; Taylor, M. 1913.1.

The larval sole (Achirus) likewise possesses pectoral fins which disappear when it is half-grown. Putnam, F. W. 1865.8, 1866.5.

The young of Onus mustela have greatly developed paired fins, which in the adult are less in proportion. Paul, D. M. 1902.2.

Sexual dimorphism in development of pectoral fins in Phoxinus. Fatio, V. 1875.1.

In Lophius, during development, there is a sudden forward translocation of the pelvic fins. Ryder, J. A. 1885.13.

Morphology of the paired fins, including their attachment to the girdles, innervation, skeleton, etc. Belling, D. E. 1911.1; Bruch, C. W. 1861.1; Hamburger, R. 1904.1; Hammarsten, O. D. 1911.1; Koltzoff, N. K. 1896.1; Nordenson, J. W. 1910.1; ★Pychlau, W. 1908.1; Rautenfeld, E. 1882.1.

The so-called "adipose lobe" of the pelvic fin of Salmo is an enlarged scale according to Shann, E. W. 1913.1.

The pectorals of Periophthalmus are modified to permit of overland locomotion. For their structural modifications, musculature, etc. see Hämmerle, L. 1897.1 and Hamburger, R. 1904.1.

The Gurnards (Triglidae) have finger-like (dactyloid or digitiform) appendages or filaments at the anterior margin of the pectoral fin by which they feel the bottom in search of their food. The following papers refer to these structures, chiefly in Prionotus and Trigla. Allen, H. 1886.1; Belling, D. E. 1911.1; Deslongchamps, J. A. 1843.1; Ewant, T. 1903.1, 2; Hamburger, R. 1904.1; Jourdain, S. 1870.1; ★Morrill, A. D. 1895.1; Tiedemann, D. F. 1816.2.

In some genera of Cyclopteridae (Cyclopterus and Liparis) and Gobiesocidae (Lepadogaster), the pelvic fins have coalesced to form a sucking disk. See Adhesive disk.

FISHERIES OF THE WORLD

For topics intimately related to the subject of fisheries, but dealing more specifically with the cultivation and propagation of fishes, see under Pisciculture. For general works relating to food fishes of various regions, see the section Fauna of the World.

It should be obvious that statements herein as to the constitution and activities of governmental departments, the International Commission for the Investigation of the Sea, etc., apply to pre-war conditions.

An excellent analysis of the publications of the U. S. Bureau of Fisheries has just appeared (April, 1921), too late, however, for more than incidental use in the preparation of this section.

This catalogue, by Miss Rose M. E. MacDonald, is entitled "An Analytical Subject Bibliography . . . 1871-1920," and is published as Appendix V to the Rept. U. S. Comm. Fish., 1920.

Treating relatively a much smaller number of papers than are comprised in the present bibliography, a plan is possible having advantages over our necessarily condensed arrangement. It should be consulted by the serious student having access to this series, comprising, in the words of Jenkins, "the finest collection of authoritative papers on fishery problems."

From the admirable work of Jenkins, cited below, much of our data concerning statistical publications in European countries has been obtained.

General treatises

Text in English. Goode, G. B. 1883.9; Hérubel, M. A. 1912.1; Russell, E. T. 1891.1; Willis-Bund, J. W. 1899.1; Wright, W. 1858.1; ★Wright, S. Add. 1908.1.

See also "The Sea Fisheries," by ★J. T. Jenkins, London, 1920. 299 p. 57 pls.

Text in French. Baudrillart, — 1827.1; Bertrand, J. E. 1779.1; Broca, P. 1865.1; Delisle de Sales, — 1769.1; Dralet, — 1821.1; ★Duhamel du Monceau, H. 1769.1, 1775.1, 1796.1; Hérubel, M. A. 1911.1; Karr, A. 1855.1-1860.1; ★La Blanchère, P. 1868.2; ★Noël de la Morinière, S. 1815.1; Perreau, J. H. 1904.1; Roule, L. 1914.8; Wallon, E. 1868.1; Thomassy, M. J. Add. 1852.1.

Text in German. ★Borne, M., Benecke, B., & Dallmer, E. 1886.1; Duhamel du Monceau, H. 1773.1; Lindeman, M. 1880.1; Meyer, J. 1881.1; Walter, E. 1903.1; Wirth, J. G. 1862.1; Anon. 633.

Text in Spanish. Valverde, — 1879.1.

Bibliographies: A selected bibliography of marine bionomics and fishery investigations. Allen, E. J. 1911.1. — *The literature of the ten principal food fishes of the North Sea.* Hoek, P. 1903.1. — *Bibliography of literature of sea and river fishing.* Manley, J. J. 1877.1-1883.1.

Historical matters

A popular history of fisheries from the earliest times. Adams, W. M. 1883.2. — *Origin of fishing.* Mortillet, L. 1867.1, 1890.1. — *Fisheries in 14th and 15th Centuries.* Segesser, A. P. 1852.1. — *The*

condition of the fisheries among the ancient Greeks and Romans. Smidth, J. K. 1872.1, 1876.1. — *The royal fishery companies of the 17th Century.* Elder, J. R. Add. 1912.1. — *Das Fischereibuch Kaiser Maximilians I.* Hohenleiter, W., & Fritz, M. Add. 1901.1. — *Fisheries of Pomerania in 12th and 13th Centuries.* Sell, J. J. Add. 1797.1, 1831.1.

Instruction in fisheries

General: Practical uses of fisheries charts. Finn, W. 1871.1. — *Technical education in relation to fishermen's occupations.* Robertson, J. W. 1916.1. — *Need of a national institute (U. S.) for technical instruction.* Smith, H. M. 1914.2. — *Practical instruction in oceanography.* Thoulet, J. Add. 1911.1.

Instruction offered at the Fisheries Laboratory at Bergen, Norway. Dean, B. 1901.2. — *At Norrnäs, Sweden.* Lundberg, R. 1879.1. — *Die Fischerschule in Evois, Finland.* Schneider, G. 1904.5, 1907.7. — *Fischereischule des Bayerischen Landes Fischereivereins in Starnberg.* Hein, W. Add. 1910.1. See also Bull. U. S. Fish Comm., 1895, xv, p. 321. — *Deutsche See-Fischerei Verein.* Henking, H. Add. 1910.1.

Ecole professionnelle de pêche à Ostende (Belgium). For description and photographs by M. Pype, consult Mém. et C. R. Congr. Intern. de Pêche et de Pisciculture à St. Pétersbourg, 1902 (1903), pp. 212-213.

Lancashire Sea Fisheries Station at Piel, England. For syllabus used in classes for fishermen, see Johnstone, J. in Rept. Lancashire Sea-Fisheries Lab., 1903 (1904), no. 12, pp. 109-128.

Living conditions of fisherfolk

Economic conditions and means for their improvement. Various items. Adams, W. M. 1883.2; Bertram, J. G. 1883.2; Blanchard, C. E. 1869.3; Levi, L. 1883.1.

French sea-fishermen. Acloque, A. 1903.1. — *Fisherfolk of Kastrup, Denmark.* Feddersen, A. F. 1878.1. — *The fishermen of the United States. General review.* Goode, G. B., & Collins, J. W. 1887.3; Collins, J. W. Add. 1894.1. — *Netherlands fishermen.* Hoek, P. 1896.3, 1908.3, 1910.1. — *Credit institution for improvement of conditions among French fishermen.* Mallet, — 1866.2. — *Seagoing fishermen of Astrakhan.* Nikolskiĭ, A. M. 1898.2. — *Swedish fishermen.* Nordström, L. 1907.1. — *Alliance of fishermen of Finkenwärder I., near Hamburg.* Voigt, F. 1878.2. — *Insurance among fisherfolk of the Great Belt, Denmark.* Winther, G. P. 1876.1. — *Italian fishermen in Algeria.* Palmisano, A. G. Add. 1904.1.

Science and Fisheries

Various articles on the relation of scientific investigation to commercial fisheries. Chudeau, R. 1900.1; Dröschner, W. 1902.1; Halbfass, W. 1902.1; Hoek, P.

1905.1,2; Janson, O. 1914.1; Kammerer, P. 1910.2; Ryder, J. A. 1894.1; Schiemenz, P. 1901.1, 1902.3; Zacharias, E. O. 1904.2.

APPARATUS & APPLIANCES

For equipment, such as dynamite, hooks, lights, poisons, spears, etc., used by native races in fishing for their own consumption, *see under* Fishing Methods.

General treatises. Perrier, J. O. 1904.1; Wilcocks, J. C. 1868.1.

Miscellanea. Delidon, E. S. 1869.1; Holdsworth, E. W. 1883.1; Leonhardt, E. E. 1906.5; Perreau, J. H. 1904.1; Walsh, R. F. 1883.1; Heublein, C. J. Add. 1774.1,2; Pontoppidan, E. Add. 1787.1; Wright, S. Add. 1908.1. — *Description of fish-measuring board.* Riddell, W. 1914.1. — *Fishery apparatus at Internat. Exposition at Bergen, 1865.* Soubeiran, J. L. 1866.2.

Fishing vessels: *Construction and equipment.* Baird, S. F. 1871.16; Nardo, G. D. 1870.1; Noël de la Morinière, S. 1806.1; Omond, J. 1883.1; Parona, C. 1899.1; Collins, J. W. Add. 1890.1.

Fish wells, live-boxes, etc., for the transportation of fishes to market. Berthelot, S. 1865.1,3; Dempster, H. 1868.1; Hughes, S. E. 1884.1; Tytler, R. C. 1865.1. — *Pre-Linn. ref.* Steele, R. 1718.1.

Nets, seines, etc.: *Construction.* Morris, C. W. 1883.1; Schneider, G. 1909.5; Augur, C. H. Add. 1894.1.

Various types of nets: *Cruive (fish-trap) fisheries in Scotland.* Calderwood, W. L. 1899.1. — *Gill-nets.* Collins, J. W. 1880.1, 1885.3. — *Action of herring seine-net.* Fulton, T. W. 1900.2. — *Drag seine (chalut), in France.* Hennequin, A. 1867.1. — *Purse seine.* Hoek, P., & Bottemanne, C. 1888.1; Martin, S. J. 1883.1; Anon. 41. — *Fyke-nets.* Smith, H. M. 1894.4. — *Covered nets.* Todd, R. A. 1908.1. — *Pound nets.* True, F. W. 1887.2. — *Drag-nets.* Gilson, G. Add. 1911.1.

Trawls: *Use of beam trawl, etc.* Ansell, A. W. 1883.1; Dantziger, C. 1879.1; Collins, J. W. Add. 1889.1. — *Otter-trawl.* Kyle, H. M. 1900.3, 1905.1.

ASSOCIATIONS & SOCIETIES

For specific societies, *see under* the various countries, below.

Miscellaneous papers. Dimick, F. F. 1914.1; Espinas, A. V. 1879.1; Lindes, L. 1880.4; Olsen, O. T. 1908.1; Schneider, G. 1904.4; Surbeck, G. 1905.3.

COMMISSIONS OF FISHERIES

For the work of the fishery boards and commissions of the various countries, *see below under* Fisheries, arranged geographically.

International Commission for the Investigation of the Sea. (*Conseil Permanent International Pour l'Exploration de*

la Mer). Subscribing governments are: Belgium, Denmark, Finland, Germany, Great Britain and Ireland, Netherlands, Norway, Russia, and Sweden. Central office in Copenhagen. Work has largely been confined to the North Sea.

The publications consist of "Rapports et Procès-Verbaux des Réunions," vol. I, 1903; "Bulletin trimestriel des résultats croisières périodiques," 1902; "Publications de circonstance," no. 1, 1903; and "Bulletin Statistique."

Scientific results of the commission. Garstang, W., 1905.2,3,6, 1906.1; Ekman, G., Pettersson, O., & Trybom, F. 1910.1; Heincke, F., & Henking, H. 1908.1; Helland-Hansen, B., & Nansen, F. 1909.2; Hjort, J. 1907.1-1910.2; Hjort, J. & Lea, E. 1911.1, 1912.1; ★Hjort, J. & Petersen, C. 1905.1; Hoek, P. P. 1903.2-1913.1; Hoek, & Kyle, H. M. 1905.1; ★Kyle, H. M. 1905.1-1908.1; Redeke, H. C. 1909.3; Anon. 142.

Early discussion concerning proposed plans of investigation. References under Allen, E. J. 1899.1. *See also* Ehrenbaum, E. 1902.1; McIntosh, W. C. 1903.3; Paton, D. N. 1902.2. *The reader should consult also the British "Blue-books," comprising an extensive literature relating to the International Investigations.*

CONGRESSES & ASSEMBLIES

Congresses of merely local importance will be found under the countries concerned. *See also* Expositions below.

First International Fishery Congress at Exposition Universelle, Paris, 1900. Chaine, J. 1900.1.

Second International Fishery Congress at St. Petersburg, Feb. 24 — March 1, 1902. *Proceedings published by* Borodin, Baranovsky, & Broschniovski (editors), as *Congrès Internat. de Pêche et de Pisciculture à St. Pétersbourg, 1903*, pt. 1, *Mém. & C. R.* 258 p.

Third International Fishery Congress at Vienna, June 4-9, 1905. *Proceedings are* *Stenographisches Protokoll über die Verhandlungen des . . . Internationalen Fischerei-Kongresses Wien, 1905.* K. K. Oesterr. Fischerei-Ges. Wien, 1905, 412 p. *For minor notes, see* Lahille, F. 1906.1; Smith, H. M. 1905.5.

Fourth International Fishery Congress at Washington, D. C., Sept. 22-26, 1908. *Proceedings published as* *Bull. U. S. Bur. Fisheries, 1908*, vol. XXVIII, in 2 parts. *See also, for comments.* Schneider, G. 1909.6; Smith, H. M. 1906.3.

Fifth International Fishery Congress at Rome, 1913. *Proceedings published as* *Atti del V. Congresso internazionale di Pesca, Roma, 1913.*

World's Fisheries Congress. Chicago, Oct. 16-20, 1893. *Report and papers, published in* *Bull. U. S. Fish Comm.* 1893 (1894), XIII. 462 p.

International fisheries conference at Stockholm, June 15-23, 1899. References under Allen, E. J. 1899.1.

Fisheries — Cont'd.**DEPLETION OF FISHERIES**

For decrease in supply of fishes in specific localities, see under *Fisheries of America*: United States; *Europe*: Austria-Hungary, British Is., Denmark, France, and Sweden.

Causes: General discussions of causes with suggested remedial measures. Baird, S. F. 1874.18, 27, 1875.1; Bartlett, S. P. 1912.1; Boccius, G. 1848.1; Bottemanne, C. J. 1872.1; Dubois, M. 1875.2; Francis, F. 1873.1; Rimbaud, J. B. 1896.1; Wieland, G. R. 1908.1; Anon. 166; Arenander, I. M. Add. 1869.1; Reindl, J. Add. 1906.1.

Destruction of immature fishes, through improper fishing apparatus with discussions of remedies, etc. Bean, T. H. 1890.9; Bourne, G. C. 1889.1; Calderwood, W. L. 1892.6; Chadwick, B. P. 1882.1, Add. 1886.1; Fulton, T. W. 1891.2, 1894.3, 1895.2; Holt, E. W. 1892.2, 1893.2; Nickerson, S. 1884.1; Sheley, G. A. 1884.1.

Investigations on the ability of undersized plaice to survive if returned to the sea, vitality of trawl-caught plaice, etc. (Few seem able to survive.) ★Borley, J. O. 1909.2; Fulton, T. W. 1890.1; Herdman, W. A. 1893.1; Masterman, A. T. 1908.1; Reitzenstein, — 1908.1.

Many of the references on the action of the various types of nets and seines given above under Apparatus and appliances, refer to the comparative destructive effects of their use upon the immature fishes.

Over-fishing as cause of depletion, chiefly of the North Sea. Ehrenbaum, E. 1895.1, 1911.1; Fulton, T. W. 1891.5; ★Garstang, W. 1900.5; Lyman, T. 1873.1, 1870.1; Petersen, C. G. 1903.3; Schneider, G. 1907.6; Bertram, J. G. Add. 1873.1.

Investigations concerning question whether quantity of commercial fishes is actually increased by liberation of artificially hatched fishes (cod and plaice). — Favorable opinion. Dahl, K. 1907.1; Dannevig, G. M. 1910.2; Fulton, T. W. 1891.5. — Opinion unfavorable. Hjort, J. 1908.2, 1909.1.

Yield of salmon fisheries in Sacramento R., Cal., almost doubled through artificial propagation. Smiley, C. W. 1884.6. — "Evidence" (pessimistic) regarding influence of salmon propagation in American rivers. Murray, W. 1903.1. — Belief in utility of sea-fish hatching. Brooks, W. K. 1889.1.

Pollution of streams

As a cause of the diminution of fishes.

Effect upon fisheries: Discussion of regulation, means of prevention, etc. Alexander, J. E. 1880.1; Anderson, John. 1880.1; Baird, S. F. 1875.4; Bean, T. H. 1892.3; Borgmann, H. 1893.1 (Soap); Buckland, F. T. 1878.3; Field, G. W. 1913.1; Filius Terræ 1877.1; Fowler, H.

W. 1914.3; Haselhoff, E., & Hünnekeier, B. 1901.1; Hofer, B. 1901.2, 1904.1; James, B. W. 1896.1; Knight, A. P. 1902.1, 1903.1, 1907.2, 3; Leonhardt, E. 1904.20; Leuckart, C. G. 1886.1; Macadam, S. 1866.1 (Paraffin oil); Massey-Mainwaring, W. 1883.1 (Sewage); Mather, F. 1876.7; Noé, J., & Dissard, A. 1894.2; Perrier, L., & Labatut, — 1900.1; Shutt, F., & Murray, J. 1900.1; Speedy, T. 1896.1; Surbeck, G. 1912.1; Prince, E. E. Add. 1900.3; Townsend, C. H. Add. 1908.1.

Possible use of *Box salpa* in water purification. Wilhelmi, J. 1911.1.

Factory and refinery refuse: Léger, L. 1912.1; Thienemann, A. 1909.1, 1911.1; Weigelt, C. 1880.1, 1885.1, Add. 1881.1; Whish, J. D. 1906.1; Tolke, C. Add. 1882.1.

Flax-steeped water, effects. Johanson, E. 1882.1; Reichardt, E. 1883.1; Steuert, L. 1903.1.

Gas manufacture wastes. Hein, W. 1908.4; McDonald, M. 1885.1, 5; Swett, S. B. 1883.1.

Starch factory refuse. Fischer, E. G. 1901.1; Hofer, B. 1903.4. — In *Obra R.*, Germany. Cronheim, W., & Schiemenz, P. 1901.1; Schiemenz, P. 1902.2.

Sugar refinery refuse. Baudran, G. 1893.1; Marsson, M., & Schiemenz, P. 1901.1.

Naphtha: Effects on fishes. Chlopin, G., & Nikitin, A. 1899.1; Kupzis, J. 1902.1; Nikolskii, A. M. 1893.1, 1898.1; Arnold, J. P. Add. 1897.1.

Sawdust: Injurious effects in streams. Bean, T. H. 1889.23; Knight, A. P. 1902.1, 1903.1, 1907.2, 3; Rasch, H. H. 1873.1, 1880.1; Zacharias, E. O. 1887.1; Landmark, A. Add. 1882.1.

Pollution in various places: *Thames R.* Bean, T. H. 1889.19. — *Pennsylvania.* Bean, T. H. 1890.33; Meehan, W. E. Add. 1911.2; Ortmann, A. E. 1909.1. — *Dauphiné, France.* Léger, L., & Doderot, G. 1905.1. — *Potomac R.* McDonald, M. 1885.5; Marsh, M. C. Add. 1907.1. — *Germany, Rhine R.* Nienhaus-Meinau, C. 1883.1; *Ruhr R.* Thienemann, A. 1912.6. — *Tyne estuary.* Paton, D. N. 1902.1. — *Pernau R., Russia.* Schneider, G. Add. 1911.1. — *Switzerland.* Schoch, G. 1892.1.

ECONOMIC PRODUCTS AND BY-PRODUCTS

General treatises. Schmidt, T. 1904.1. — *The commercial products of the sea.* ★Simmonds, P. L. 1879.1, 1883.1.

Varia: Preparing shark skin in the Philippines. Seale, A. 1911.1. — *Diodon-skin helmets in South Sea islands.* Wilkes, C. Add. 1845.1.

For use of fishes in the medical practice of the 16th–18th Centuries, see Medical properties.

Artificial Pearls

Manufactured chiefly in Paris by coating the inside of hollow glass globules

with guanin known as "Essence d'orient," or "blanc d'ablette," obtained from the lining of the scales of the "Ablette" or Bleak (*Alburnus lucidus*).

Accounts of manufacture. Badham, C. D. 1854.1; Cuvier & Valenciennes 1828.1 (Vol. 17, p. 287).

Chemical composition of "blanc d'ablette" and demonstration by Barreswil of its identity with guanin. Barreswil, — Add. 1861.1; Bethe, A. 1895.1; Voit, Carl, 1865.1.

Nature of material used in artificial pearls. Réaumur, R. A. Pre-Linn. 1718.1.

Fertilizer as a by-product

Various papers on use of fish-scrap, refuse, etc., as fertilizer. Baird, S. F. 1873.11; Bobierre, A. 1868.1; Dean, S. 1797.1; Hamilton, R. B. 1853.1; Hunt, T. S. 1859.1; Klippart, J. H. 1861.1; Smiley, C. W. 1884.3; Smith, W. A. 1883.4; Weigelt, C. 1891.1; Woods, J. E. 1888.1 (*In East Indies*); Anon. 214; Robinson, J. A. Add. 1912.1; Stevenson, C. H. Add. 1904.1; Tarrantine, J. W. Add. 1913.1.

Analysis or composition of fish guano. Anderson, T. 1857.1; Dietzell, B. E. & Kressner, M. G. 1879.1; Gruvel, A., & Chudeau, R. 1911.1; Johnson, S. W. 1860.1; Malaguti, F. J. 1864.1; Atwater, W. O. Add. 1884.2.

Dogfish used for fertilizer. Gallup, B. F. 1883.1.

Fish guano in Norway. Baird, S. F. 1871.15; Vohl, H. 1863.1; Anon. 555; Crowe, — Add. 1882.1.

Herring brine, use in agriculture. Girardin, J., & Marchand, E. 1860.1; Quatre-fages, J. L. 1848.2; Winkles, G. H. 1855.1; Anon. 43.

Menhaden used for fertilizer. Atwater, W. O. 1879.1; Goode, G. B. 1880.20; Goode & Atwater 1880.1; Jackson, C. T. 1856.1; Boardman, S. L., & Atkins, C. G. Add. 1876.1.

Food; use of fishes for food

For methods of canning, curing, packing, salting, etc., see below under *Preservation*.

For sickness caused by eating certain tropical fishes, see under *Poisonous fishes*.

Fish as cattle food: Smith, J. V. 1833.1; Woods, J. E. 1888.1; Anon. 668; Hinckley, I. Add. 1881.1; Jameson, R. Add. 1826.1; Ovington, J. Pre-Linn. 1696.1.

Miscellanea: *Papers on the use of fishes as food.* Bean, T. H. 1910.14; Belamy, J. C. 1843.1; Bernard, T. 1813.1; Blackford, E. G. 1879.2, Add. 1895.1; Champion, P. 1865.1; Davy, J. 1853.1; Duméril, A. 1865.1, 2, 1870.2; Filippi, F. 1853.1; Huitsfeldt-Kaas, H. 1901.1; Huntington, L. D. 1897.1; Kiss, E. 1871.1; Langworthy, C. F. 1898.1; Léger, L. 1910.2; Leonhardt, E. E. 1901.2, 1904.2; Payen, A. 1855.1; Reider, J. E. 1825.1; Schneider, G. 1900.6, 1901.2,

1902.3, 4, 5; Stearns, S. 1880.1; Thompson, H. 1883.1; Weigelt, C. 1896.1; Yarell, W. 1857.1; Anon. 231; Ghibourt, J. Add. 1851.1; König, J., & Splittgerber, A. Add. 1909.1; Longworthy, C. F. Add. 1898.1; ★Simmonds, P. L. Add. 1885.1.

Pre-Linn. references to use of fishes as food. Albin, E. 1724.1; Baricelli, J. C. 1617.1; Camerarius, J. R. 1624.1; Cousin, J. & Le Vasseur, C. 1637.1; Geoffroy, C. 1735.1; Morton, T. 1632.1; Seguin, P., & Chasler, H. 1628.1.

Ichthyophagi or "fish-eaters," a name given by ancient geographers and other old writers to several ethnically unrelated coast-dwelling peoples in different parts of the world, who subsisted principally on fish. *Various early references in Pre-Linn. section.* Arrian, F. 1508.1; Athenæus, N. 1680.1; Erasmus, D. 1725.1; Geyer, J. D. 1735.1; Herodotus, 1709.1; Nonnius, L. 1616.1; Polo, M. 1496.1; Strabo, 1742.1.

Nutritive value: *Comparison of fish with meats, relative digestibility, etc.* ★Atwater, W. O. 1879.1–1888.1, Add. 1884.3, 1892.1; Hollande, A. Ch. 1913.1; Maitland, R. T. 1854.1; Milone, U. 1897.1; Mitchell, R. W. 1883.1; Philips, B. 1874.1, 1877.2; Schrumpf, P. 1911.1; Buckland, F. Add. 1878.1; ★Chittenden, — & Cummins, — Add. 1886.1; Clarkson, R. D. Add. 1887.1; Kostytscheff, P. Add. 1889.1; Popoff, M. Add. 1882.1. — *Amount of fat in different fishes.* Hughes, F. Add. 1891.1. — *Alkaloid-like bodies in dried sturgeon.* Lieventhal, E. Add. 1886.1. *For additional references on chemical analyses of the flesh of fishes, see below Analysis of fish flesh under Chemistry, etc.*

Various fishes and preparations: *Botargo, salted mullet roe.* Armand, B. 1897.1; Wallut, C. 1863.1.

Garum, fish sauce of the ancients. Cuvier, G. L., & Valenciennes, A. 1832.1; Woods, J. E. 1888.1.

Spinal column of sturgeon as an article of food. Baird, S. F. 1874.22.

Dogfish, sharks and rays; economic uses and use for food. Atkins, S. G. 1905.1; Duméril, A. H. 1865.2; Field, G. W. 1912.1; Field, I. A. 1907.1, 1908.1; Glage, F. 1902.1; Miles, G. W. 1913.1; Smith, H. M. 1916.2.

Various fishes used as food. *Pompano.* Blackford, E. G. 1879.2. — *Oulachan.* Brown, Robert. 1868.1. — *Salmon.* Dunlop, J. C. 1900.1; Throckmorton, S. R. 1874.1. — *Herring.* Milroy, T. H. 1906.1, 1908.1; Ronsseus, Add. 1778.1. — *Lampræy.* Muckett, N. M. 1879.1. — *Goosefish.* Smith, H. M. Add. 1914.1.

Glue

Composition, manufacture, etc. Camera, — Add. 1789.1; Chevalier, — Add. 1774.1; Davidowsky, F. Add. 1905.1; Müller, G. F. Add. 1768.1; Soubeiran, J. L. 1866.1; Winkler, T. C. 1861.3.

Fisheries—Cont'd.

Pre-Linn. references. Pomet, P. 1737.1; Stolze, — 1756.1. — *Glue from perch*. Linnæus, C. 1739.1.

Isinglass

Discovery, nature, production, properties, etc. Brandt, J. F. 1831.1,2; Brandt, & Ratzeburg, J. 1829.1; Jackson, H. 1773.1, Add. 1766.1; Davidson, S. C. Add. 1839.1; Knudsen, H. Add. 1885.1; Prince, E. E. Add. 1905.1.

Preparation in the Philippines. Seale, A. 1911.1.

Manufacture of East Indian isinglass for the European market. Woods, J. E. 1888.1; McClelland, J. Add. 1843.1; O'Reilly, E. Add. 1842.1; Royle, J. F. Add. 1842.1,2. — *Polynemus sele of Ganges*. Bogle, — 1842.1; Cantor, T. E. 1839.2; M'Clelland, J. 1839.3.

Isinglass made by Turks from sturgeon. Tavernier, J. B. Pre-Linn. 1676.1.

Oils of fishes

Miscellaneous papers on fish oils: properties, uses, etc. Bostock, J. 1820.1; Brugnatelli, L. G. 1815.1; Day, F. 1870.7; Delattre, A. 1859.1; Grimm, O. 1882.1; Jameson, R. 1800.1; Knapp, F. H. 1846.1; M., A. 1870.1; Posselt, W. 1826.1; Soubeiran, J. L. 1867.1; Vanherman, T. 1806.1; White, G. F., & Thomas, A. 1914.2; Willebrand, K. F. 1866.1; ★Stevenson, C. H. Add. 1904.1; White, G. F. Add. 1914.1; Wright, C. R., & Mitchell, C. A. Add. 1903.1; Westbeck, Z. Pre-Linn. 1754.1.

Manufacture, methods of purification, etc. Davidson, W. 1827.1, 1840.1; Dossie, R. 1803.1; Girardin, J., & Preisser, F. 1841.1.

Cod-liver oil: *Various papers.* Baucher, F. J. 1878.1; McCulloch, J. R. 1869.1; Møller, P. 1862.1; Mulder, G. J. 1849.1; Pereira, J. 1849.1; ★Roussel, J. 1900.1; Thomas, E. A. Add. 1854.1. — *Variations in yield.* Atwood, N. E. Add. 1883.1; Schieffelin, W. H. Add. 1883.1.

Chemical composition. Brefeld, F. 1835.1; ★Gautier, A., & Mourgues, L. 1888.1,2; Jongh, L. J. 1842.1; Marder, C. 1830.1; Riegel, E. 1852.1; Rump, — & Lehnert, — 1904.1. — *Iodine content.* Graeger, J. N. 1841.1; Stanford, E. C. 1884.1; Stein, W. 1840.1; Ulre, A. 1843.1; Vallet, A. G. 1837.1.

Medicinal and physiological properties. Capsoni, G. 1831.1; Despinoy, — & Garreau, — 1870.1; ★Naumann, O. 1865.1; Thompson, T. 1854.1, 1857.1; ★Bouillot, J. Add. 1892.1, 1893.1.

Shark and ray oils: Gallup, B. F. 1883.1; Girardin, J., & Preisser, F. 1842.1; Hooper, D. 1909.1; Odin, A. 1873.1.

Oil shark of southern California. Jordan, D. S. & Gilbert, C. H. 1880.37; Yarrow, H. C. 1880.1.

Quantity of oil in Basking shark. Pengelly, W. 1891.1.

Oils of various fishes: *Eulachon oil.* Redwood, T. 1880.1; Swan, J. G. 1882.1. — *Hake liver oil.* Homolle, — 1854.1. — *Herring oil.* Bloch, M. E. Add. 1784.1; Quatrefages, J. L. 1848.2. — *Menhaden oil.* C., H. E. 1871.1; Jackson, C. T. 1856.1; Barker, E. L. Add. 1883.1.

Purgative effects of oil of Ruvettus pretiosus, purge-fish of the South Seas. Krämer, A. 1901.1; Waite, E. R. 1899.1.

EXPOSITIONS & EXHIBITIONS**North America**

(United States)

Atlanta, Cotton States Exposition, 1905. *Report of representative of U. S. Fish Comm.* Ravenel, W. 1898.1.

Buffalo, Pan-American Exposition. *Chilean exhibit.* Delfin, F. T. 1901.1; Reed, E. C. 1901.1. — *Report of representative of U. S. F. C.* Ravenel, W. 1902.1.

Chicago, World's Columbian Exposition, 1893. *Fisheries exhibit.* Bean, T. H. 1891.22, 1892.4, Add. 1896.1; Collins, J. W. 1892.1, 1894.1; Ehrenbaum, E. 1894.1; Lönnberg, A. J. 1893.3; Nordquist, O. F. 1893.3; Schillinger, A. 1894.1. — *Aquarium exhibit, report of Director.* Forbes, S. A. 1894.1. — *British section, catalogue.* Anon. 133. — *The angling exhibit.* Henshall, J. A. Add. 1893.1. — *New South Wales, exhibit.* Cohen, P. Add. 1892.1. — *Pennsylvania exhibit.* Meehan, W. E. Add. 1893.1.

Cincinnati, Centennial Exposition, 1889. *Report of participation of U. S. F. C.* Collins, J. W. Add. 1892.3.

Nashville, Tenn., Centennial Exposition, 1897. *U. S. F. C. exhibit.* Ravenel, W. Add. 1899.1.

Philadelphia, World's Exposition, 1876. Anderssen, J. 1878.1, 1880.1. — *Exhibit of Smithsonian Institution, catalogue.* Goode, G. B. 1879.3, 1882.2.

St. Louis, Louisiana Purchase Exposition, 1904. Ehrenbaum, E. 1905.2; Smith, H. M. 1904.11; Bean, T. H. Add. 1904.1.

Europe

Austria-Hungary: *Stuhlweissenburg, Landes-Producten-Ausstellung.* Brehm, H. 1879.1.

Vienna, Wiener Weltausstellung, 1873. Wittmack, M. C. 1875.2.

Vienna, Internationale Fischerei-Ausstellung, 1902. Eberts, — 1903.1; Kozhevnikov, G. A. 1904.1.

Belgium: *Bruxelles-Tervueren, Exposition Internationale, 1897.* Anon. 195.

British Isles; England: *Liverpool, Sea-fisheries exhibition.* Herdman, W. A., Scott, A., & Johnstone, J. 1898.1.

London, Royal Aquarium exhibition, 1892. Bean, T. H. 1892.13.

London, Great International Fisheries Exhibition, 1883. For the complete literature in 14 vols., (Handbooks, Conferences, etc.) see references under Anon. 346 on p. 690, vol. II. — *Various comments, notes on exhibits, etc.* Benecke, B.

1886.4; Day, F. 1883.5; Duff, R. W. 1885.1; Lankester, E. R. 1883.1; Raveret-Wattel, C. 1884.4; ★Whymper, F. 1884.1; Turner, G. Add. 1883.1 (Guide); Wallem, F. M. Add. 1885.1. — *Indian section, catalogue.* Day, F. 1883.1. — *Swedish collection.* Dickson, O. 1882.1, 2 (Catalogue); Ljungman, A. V. Add. 1883.1. — *New South Wales section, catalogue.* Ramsay, E. P. 1883.1. — *Chinese collection, catalogue.* Anon. 134. — *U. S. exhibit.* Goode, G. B. (Catalogue) 1883.5, .15; Hubrecht, A. 1883.1; Clark, A. H. Add. 1883.1; Collins, J. W. Add. 1883.1; Lowell, J. R. Add. 1883.1. — *Exhibit of U. S. National Museum.* Bean, T. H. 1883.1 (Catalogue); Earll, R. E. Add. 1883.1, 2.

British Isles; Scotland: *Edinburgh, International Fisheries Exhibition, 1882. Reports.* Leonard, J. A. 1883.1; Raveret-Wattel, C. 1884.4. — *Selection from prize essays.* Herbert, D. 1883.1. — *Official papers.* McCaskie, A. 1882.1.

France: *Arcachon, Exposition internationale de pêche et d'aquiculture, 1866.* Comettant, O. 1869.1; Soubeiran, J. L. 1871.2; Anon. 234; Graells, M. Add. 1867.1.

Boulogne-sur-Mer, Exposition internationale de pêche, 1866. Reports. Baars, H. 1867.2; Brouwer, E. 1868.1; Magnier, E. 1866.2; Soubeiran, J. L. 1871.2; Anon. 297; Graells, M. Add. 1867.1.

Hâvre, Exposition internationale maritime, 1868. Clavé, J. 1868.1, 2; Gailois, N. 1868.1; Hoogendijk, J. 1870.1; Rénard, L. 1868.1; Soubeiran, J. L. 1871.2; Anon. 197; (Catalogue) Anon. 198.

Marseille, Exposition coloniale, 1906. Benard, C. Add. 1907.1; Anon. 196.

Paris, Exposition universelle, 1878. Gobin, A. 1879.1; Raveret-Wattel, C. 1879.2; Silva Ferro, R. 1879.1; Anon. 199.

Paris, Exposition des animaux reproducteurs, 1854. Report of commission. Montgaudry, — 1854.2.

Paris, Exposition universelle, 1900. Kozhevnikov, G. A. 1901.1; Raveret-Wattel, C. 1889.4.

Germany: *Berlin. Ausstellung von Gerätschaften und produkten der See- und Binnenfischerei, 1873.* Anon. 121.

Berlin, Gewerbeausstellung. Matzdorff, C. 1897.1.

Berlin, Internationale Fischerei-Ausstellung, 1880. For the "official papers" see Anon. 97. — *Various accounts, notes, etc.* Angerstein, W. 1880.1; Gens, E. 1880.1; Goode, G. B. 1880.2, 5; Lucas, F. A. 1880.1; Raveret-Wattel, C. 1881.1, 1883.3; Vinciguerra, D. 1880.2; Wallem, F. M. Add. 1881.1. — *Aquarium exhibit.* Friedel, E. 1880.2. — *U. S. exhibit.* Goode, G. B. 1880.3 (Catalogue), 1880.9, .14; Haack, H. 1882.1. — *Angling exhibit.* L., J. 1880.1. — *Japanese section, catalogue.* Matsubara, S. 1880.1. — *Exhibit of Venice.* Ninni, A. P. 1880.1. — *Museo civico of Genoa, exhibit.* Anon. 443.

Friedrichshafen (am Bodensee), Fischerei-Ausstellung am vierten deutschen Fischereitag. Klunzinger, C. B. 1892.2.

Italy: *Milan, Exposition of 1894.* Bettoni, E. 1894.1; Fuhrmann, O. 1906.2.

Netherlands: *Amsterdam, Internationale Fiskeri-Udstilling, 1861.* Baars, H. 1862.2; Blytt, H. 1862.1; Brouwer, E. 1862.1; Longuét, L. 1862.1; Anon. 128 (Catalogue), 593.

s'Gravenhage (The Hague), Internationale tentoonstelling van visscherij, 1867. Eeden, F. W. 1870.1; Soubeiran, J. L. 1869.1; Anon. 126, 592.

Norway: *Aalesund fishery exposition, 1864.* Anon. 9.

Bergen, Internationale Fiskeri-Udstilling, 1865. Beneden, P. J. 1866.1, 2 (Reports); Brouwer, E. 1866.1; Lebeau, J., & Longuét, L. 1866.1; Soubeiran, J. L. 1866.2; Widegren, H. 1865.4. — *Report of French Commission.* Champeaux, — 1866.1. — *Report and catalogue.* Anon. 93, 122. — *Dutch exhibits, catalogue and report.* Anon. 125, 590.

Bergen, International Exhibition of 1898. Heinke, F. 1901.1. — *Report of U. S. Commissioner.* Collins, J. W. Add. 1901.1.

Russia: *Moscow, Exposition of Hydrobiology, Fisheries and Pisciculture, 1903.* Lebedintsev, A. A. 1903.1; Anon. 460.

St. Petersburg, International Fisheries Exhibition, 1902. Duge, F., Henking, H., & Wilhelm, O. Add. 1902.1; Lebedintsev, A. A. 1903.1; Anon. 96.

Sweden: *Gothenburg Exposition.* Baird, S. F. 1872.12.

Karlstad exhibition, 1903. Lönnberg, A. 1903.4.

Switzerland: *Bern, Schweizerische Fischerei-Ausstellung, 1895.* Schubiger, — 1895.1.

Bern: Exposition nationale suisse, 1914. Surbeck, G. 1912.3.

Zürich, Fischerei-Ausstellung. Schoch, G. 1894.2.

LEGISLATION & PROTECTION

General: *Relations of the state with fishermen and fisheries.* Chater, F. 1883.1; Fryer, C. E. 1883.2. — *Droits de pêche.* M., — 1775.1. — *The fishery laws.* Pollock, F. 1884.1; Preyer, C. 1876.1. — *Principles of fishery legislation.* Shaw-Lefevre, G. 1883.1.

Early legal dissertations on fishery rights. Text chiefly in Latin. Gael, J. 1765.1. — *References in Pre-Linn. section.* Fischer, F. M. 1719.1; Hahn, J. 1678.1; Hayden-peucher, J. G. 1602.1; Meurer, N. 1563.1; Reck, M. 1662.1; Volckhart, J. 1671.1; Wardenburg, C. T. 1757.1; Salenius, J. G. 1663.1.

Laws, regulations, advocacy of measures such as closed seasons, licenses, regulation of apparatus used, etc., for the protection and increase of fishes. Alexander, J. E. 1867.1, 1880.1; Baird, S. F. 1873.5; Bean, T. H. 1892.16; Blackford, E. G. 1885.1; Cun-

Fisheries — *Cont'd.*

ningham, J. T. 1893.8; Dennis, O. M., 1909.1, Add. 1910.1; Dicherson, F. B. 1899.1; Fullerton, S. F. 1907.1; Heincke, F. 1913.1; Palmer, T. S. 1912.1; Petersen, C. G. 1902.2; Rice, L. M. 1915.1; Smith, H. Hammond. 1913.1; Smith, H. M. 1912.7; Southwick, J. M. 1894.1; Thomson, G. H. 1910.1, 1913.1; Wilmot, S. 1876.1; Canu, E. Add. 1894.1; Meehan, W. E. Add. 1901.2; Prince, E. E. Add. 1900.2.

Effects of closure for certain periods of areas in the Scottish seas. McIntosh, W. C. 1899.2-4.

Practical enforcement of fishery regulations; work of fish wardens, powers of fish commissioners, etc. Brewster, C. E. 1901.1; Morse, G. M. 1901.1; Organ, R. B. 1880.1; Perce, H. W. 1908.1; Prince, E. E. 1901.2; Evans, A. K. Add. 1911.1.

Miscellanea: Papers on fish protection. Amsden, F. J. 1896.1; Borgmann, H. 1898.1; Bower, S. 1898.1; Gens, E. 1879.1; Goldsmith, M. 1875.1; Goode, G. B. 1883.11; Green, S. 1874.7; Hallock, C. 1875.4; Henshall, J. A. 1891.2, 1905.1; Schneider, G. 1898.1; Zur Mühlen, M. 1911.18.

International regulations of the fisheries of the high seas. Goode, G. B. 1884.3; Reeves, J. 1792.1; ★Stevenson, C. H. 1910.2; Fryer, C. E. Add. 1910.1; James, B. W. Add. 1898.1; Olsen, O. T. Add. 1910.1.

Work of the International Commission of Canada and the United States. Jordan, D. S. Add. 1910.1; Rathbun, R., & Wakeham, W. Add. 1897.1.

Northwestern Atlantic Fisheries Dispute between Great Britain and the United States. Goode, G. B. 1879.10; Snow, F. 1894.1; Boyd, W. Add. 1886.1; Doran, J. I. Add. 1888.1; Elliott, C. B. Add. 1887.1; Henderson, J. B. Add. 1901.1; Isham, C. Add. 1887.1; Ricci, J. H. Add. 1888.1.

Legal aspects of the fisheries question. Marsh, A. H. 1887.1; Moore, J. B. 1906.1. — *As affected by treaties of 1783, 1818, 1854 and 1871.* Schuyler, E. 1866.1. — *As affected by Treaty of Washington, February 9, 1872.* Anon. 38. — *Proceedings of Halifax Commission, 1877, and Treaty of Washington, May 8, 1871.* Anon. 79. — *Terms of Treaty of 1818.* Elliott, C. B. Add. 1887.1. — *Awards, after arbitration at the Hague, 1910.* McFarland, R. 1911.1; Smith, H. M. 1911.2; ★White, J. 1911.1.

MARKETING PLACES

General: *Fish market reform.* Dempster, H. 1868.1. — *Value of market statistics.* Petersen, C., Kyle, H., & Johansen, A. 1905.1. — *General account.* Walpole, S. 1883.2.

Africa: *Egypt. Fish markets on the Nile R.* Werner, Franz. 1906.2.

America: *U. S., New York City, Fulton market.* Blackford, E. G. 1879.1, 2;

Lamphear, G. 1881.1. — *Virginia, Norfolk.* H. 1876.1. — *California, San Francisco market.* Lockington, W. N. 1880.21.

West Indies, Bermuda. Goode, G. B. 1876.1. — *Cuba, Havana.* Poey y Aloy, F. 1883.1.

Europe: *Austria-Hungary, Vienna market.* Krisch, A. 1900.2. — *Triest.* Plucàr, E. 1846.1. — *Lussin-Piccolo.* Wölfelin, L. G. 1901.1.

British Isles; England, Billingsgate market of London. Cayley, J., & Bridgman, H. 1883.1; Cox, W. 1886.1; Walpole, S. 1881.1; Haecken, A. Pre-Linn. 1734.1. — *Lowestoft market.* Southwell, T. 1901.1.

France, La Vendée. Cocaud, M. 1896.1. — *Paris market.* Pellegrin, J. Add. 1912.1; Stork, H. 1880.1.

Germany, Altona. Brix, Musset, & Ehrenberg. Add. 1896.1. — *Cologne.* Kuske, Add. 1905.1.

Italy, Naples, vernacular names. Police, G. 1912.2.

Turkey, Constantinople market. Schleiff, V. 1902.1.

PRESERVATION' METHODS

— For use of fish as food, see above, under Economic Products.

General treatises. ★Stevenson, C. H. Add. 1899.1; Anon. 144. — See also "The Art of Fish-curing," published by the Fish Trades Gazette, London.

Miscellaneous papers on preservation. Erichsen, J. 1781.1; Fiebiger, J. 1909.1; Leonhardt, E. E. 1904.14; Plucàr, E. 1846.1; Sucker, L. 1895.1; Anon. 32. — *Fish-canning plant on shipboard.* Cobb, J. N. 1912.1. — *Preserving fish with sugar.* MacCulloch, J. 1822.1. — *Kuvalehti, a Finnish national dish.* Malmberg, A. J. 1876.1. — *Preserved fish in East Indies.* Woods, J. E. 1888.1. — *Preservation practices in the 14th Century.* Anon. 14. — *Preservation of commercial fishery products in the tropics.* Seale, A. Add. 1914.1. — *Experiments on keeping fish in limewater.* Hales, S. Pre-Linn. 1754.1; Hume, F. Pre-Linn. 1754.1.

Acids: *Acetic, boracic, salicylic and other acids.* Clark, A. H. 1888.1.

Boracic acid, or so-called Roosen process for temporary preservation. Ewart, J. C. 1887.2; Malmros, O. 1887.1; Roosen, A. R. 1879.1.

Curing, drying, and smoking: *Lauder, T. D.* 1846.1; *Lönnerberg, A. J.* 1906.4; *Smith, W. A.* 1883.1; *Garde, Aug.* Add. 1885.1; *Gundersen, H.* Add. 1886.1. — *Method of drying fish in Chile.* Castillo, L. 1912.6, 7. — *Methods employed in English fisheries.* Collins, J. W. 1885.1. — *Curing fish in Scotland.* Ross, J. 1883.1. — *Chemical and microbiological investigations.* Schmidt-Nielsen, S. 1900.1. — *Smoked haddocks, Scotch method.* Smith, H. M. 1902.7.

Decomposition: Anderson, A. G. 1909.1. — *Putrefaction in herring caused during salting by crustacean food (aat)*. Boeck, A. 1866.1, 1868.1; Meier, H. 1869.2. — *Putrefaction, relation to rigor mortis*. Ewart, J. C. 1887.1.

"Red cod": nature of organisms (bacterial) and cause of red coloration. ★Bitting, A. W. 1911.1; Farlow, W. G. 1880.1, 1886.1; Johan-Olsen, O. 1887.1; Berthier, C. Add. 1889.1; Edington, A. Add. 1888.1; Ewart, J. C. Add. 1888.1; Layet, A. Add. 1887.1; Layet, Artigalas, & Ferré. Add. 1886.1.

It has been recently shown by H. F. Taylor (U. S. Bureau Fish., Doc. 919, 1922, p. 18) that the organisms which cause the reddening of cod and haddock are of two kinds — "a spirochæte which in colonies is pale pink, and a bacillus whose colonies are deep red."

Measures for prohibition of sale. Mauriac, E. Add. 1886.1, 1889.1; Pouchet, G. Add. 1886.1.

Possibility of use for food. Grancher. Add. 1887.1; Heckel, E. Add. 1887.2.

For cases of sickness caused by eating "red cod," see Diseases of man.

Refrigeration: including methods of packing in ice for shipment. Baird, S. F. 1871.2, 34; Bourgeois, — 1879.1; Castillo, L. 1912.10; Cox, W. 1887.1; Gamgee, J. 1879.1; Kilbourn, J. K. 1883.1; Lahille, F. 1910.1; Smith, W. A. 1883.2; Clark, A. H. Add. 1887.1; Mouchy, A. Add. 1911.1; Sölling, A. Add. 1910.1; ★Stevenson, C. H. Add. 1899.1; Tower, R. W. Add. 1901.1. — *History of frozen fish trade of U. S.* Clark, A. 1887.5.

Salting and pickling: Annaniassen, A. 1885.1; Bitting, A. W. 1911.1; Martin, M. 1834.1; Trolle, C. 1886.1; Pettersson, A. Add. 1900.1; Schmidt-Nielsen, S. Add. 1901.1; Stevenson, C. H. Add. 1899.1. — *Salting and pickling among Greeks and Romans*. Smidth, J. K. 1872.1, 1876.1.

STATIONS & LABORATORIES

Engaged in researches on life histories, development, etc., for the promotion of scientific knowledge of fishes and fisheries. For stations engaged primarily in the propagation of fishes, see Stations & Establishments under Pisciculture.

America

British Columbia: Pacific Coast Biological Station, Departure Bay. Fraser, C. M. Add. 1914.1.

California: The Hopkins Seaside Laboratory at Monterey. Dean, B. 1897.1; Jenkins, O. P. 1893.1.

Marine Biological Station of San Diego. Gravier, C. 1912.1; Ritter, W. E. 1912.1.

Florida: Utility of [proposed] station on Florida coast. Meek, S. E. Add. 1898.1; Taylor, W. E. Add. 1898.1.

Massachusetts: Biological Laboratory of the U. S. Fish Comm. at Woods Hole,

activities, etc. Bumpus, H. C. 1898.7, 1900.1; Ryder, J. A. 1892.2; Sumner, F. B. 1904.3, 1905.1, 1907.1, 1908.1.

North Carolina: Beaufort Lab. of U. S. Fish Comm., Reports, etc. Grave, C. 1905.1; Radcliffe, L. 1914.2.

Rhode Island: Fisheries Experiment Station at Wickford, R. I. Report of work during 1910. Barnes, E. W. Add. 1911.1.

Asia

Japan: Fisheries Institute Suisan Koschushio at Tokio. Hindze, B. K. 1903.1.

Imperial University Station at Misaki. Dean, B. 1904.13; Mitsukuri, K. 1887.1.

Europe

For detailed descriptions of European Stations, see ★Kofoid, C. A. Add. 1910.1. Consult also Dean, B., in Rept. Smithsonian Instit., 1893 (1894), pp. 505-519. For account in Russian, see Borodin, N. A. 1894.1.

Austria-Hungary: Royal Hungarian Biological Station for Fisheries and for Purification of Sewage. (Description.) Unger, E. 1910.2.

British Isles; England: Dove Marine Laboratory, Cullercoats near Newcastle, Northumberland. Report of scientific work. Meek, A. 1898.1.

Laboratory of the Marine Biological Association of Plymouth. Reports on investigations. Browne, F. B. 1903.1; Cunningham, J. T. 1887.6, 1893.2; Duncker, G. 1897.3. — Description. Heape, W. 1887.1. — List of publications, 1886-1913. Anon. 343.

Lancashire and Western Sea Fisheries Committee. Fisheries Laboratory at University of Liverpool. Biological Station and Hatchery at Piel-in-Barrow. — Reports on activities and investigations. Herdman, W. A. 1893.1, 1897.2, 1903.2, 5, 1913.3, Add. 1914.1; Herdman, & Scott, A. 1894.1; Herdman, Scott, & Johnstone, J. 1890.1-1910.1; Herdman, Scott, Johnstone, & Cole, F. J. 1902.1; Scott, A. 1901.1, 1902.1, 1905.3, 1913.1, 2, 1915.3. — Description of the fisheries cruiser, "James Fletcher." Wignall, A., & Johnstone, J. 1908.1.

Liverpool Marine Biology Committee. Port Erin Biological Station. Activities. Herdman, W. A. 1903.1, 1906.1. — Puffin Island Station. Foundation and first season's activities. Herdman, W. A. 1888.1.

British Isles, Scotland: Gatty Marine Laboratory at St. Andrews, formerly Laboratory of Fishery Board for Scotland. — Foundation and history of the Gatty Marine Laboratory. ★McIntosh, W. C. 1896.2. — Reports of activities. McIntosh, W. C. 1885.5, 1887.3, 1888.5, Add. 1884.1, 1886.1, 1895.1, 1912.1; Prince, E. E. 1885.1, 1911.1. — For activities of Fishery Board for Scotland, see under Fisheries, Scotland.

Fisheries — Cont'd.

Denmark: *Danish Biological Station at Nyborg, Fyen I. Reports.* Petersen, C. G. 1891.1, 1893.1. — *Results of Dr. Petersen's work as Director of this station appeared as "Beretning fra der dansk biologiske Station," I-XVII, 1890-1908, and "Fiskeri Beretning" of the statistical branch of the Danish Fisheries Bureau. — English comments on this work.* Holt, E. 1897.7; Stead, F. B. 1897.1.

France: *Laboratory of Marine Zoology and Physiology at Concarneau of the Collège de France. Reports upon investigations of this laboratory are reprinted in "Travaux scientifiques du Laboratoire . . . Maritime de Concarneau, begun in 1909. See also Pouchet, G. 1887.3, 1889.1. — Descriptions of the "vivier" or culture basin.* Gillet de Grandmont, A. 1864.2; Moquin-Tandon, G., & Soubeiran, J. L. 1865.1.

Marine Laboratory of the National Museum of Natural History at Tatihou near Saint-Vaast-La-Hougue (Manche). Researches. Anthony, R. 1907.2, 1908.2, 1909.2; Malard, A. E. 1890.1; Perrier, J., & Anthony, R. 1907.1. — *Annual reports of operations and résumés of all published work are published in the "Annales des Sciences Naturelles" (Zoologie).*

Zoological Station of Cette (Hérault). Description. Calvet, L. 1905.1. *Results of researches are published in "Travaux de l'Institut de Zoologie de Montpellier et de la Station Zoologique de Cette."*

Germany: *Account of an itinerant station on the North Sea coast, 1888.* Ehrenbaum, E. 1889.2.

German Scientific Commission for the Investigation of the Sea, University of Kiel. — Review of thirty years' work. Hensen, V. 1901.1. — *Publications of the Commission are the "Jahresberichte," I-IV, 1871-76, and "Berichte," IV-VI, 1877-1891. After 1893, a joint publication with the Helgoland Station appeared as "Wissenschaftliche Meeresuntersuchungen."*

Royal Prussian Biological Station of Helgoland. Activities. Ehrenbaum, E. 1897.1-1910.1; Heincke, F. 1906.1, 1908.1; Henking, H. 1906.1, 1908.2; Strodtmann, S. 1906.1-1908.1.

Royal Prussian Institute for Inland Fisheries, Friedrichshagen am Müggel-See near Berlin. Martell, P. 1915.1; Schiemenz, P. 1911.1.

Italy: *Zoological Station, Naples. Researches on fishes.* Dohrn, A. 1882.2-1892.1; Hoek, P. 1890.7, 1891.3; Lo Bianco, S. 1888.1-1911.2; Mazzarelli, G. F. 1908.1; Schmidlein, R. 1879.1. — *Letter to S. F. Baird.* Dohrn, A. Add. 1883.1.

Norway: *Biological Station at Bergen.* Brunchorst, J. 1891.1. — *Instruction offered.* Dean, B. 1901.2. — *Report of researches.* Nordgaard, O. 1896.1.

Trondhjem Biological Station at Haegadalen, near Trondhjem. Experiments in

breeding Pleuronectes. Nordgaard, O. 1909.1, 1914.1.

Russia: *Marine Biological Station on the Murman Coast at Alexandrovsk, Archangel Govt.* Derjugin, K. M. 1906.1.

Finland Fisheries Experiment Station at Evois. Activities. Ericsson, B. 1900.1-1904.1; Nordqvist, O. F. 1894.6, 1896.2, 1899.5; Nordqvist, & Ericsson, B. 1896.1; Schneider, G. 1904.1. — *Fish culture experiments in lakes near Evois.* Levander, K. M. 1906.1; Sandman, J. A. 1905.4.

Summer Zoological Station, Esbo-Löfö, Finland. Stenroos, Palmén, Levander, & Westerlund. 1893.1.

Volga Biological Station at Saratof. Behning, A. L. 1913.1; Meissner, V. I. 1908.1.

Sweden: *Fresh-water Biological Station at Aneboda. Activities.* Nordqvist, O. F. 1906.4, 1910.5, 1911.1, 1912.1, 1913.1; Schneider, G. 1907.1, 3, 1909.4.

Oceanica

New Zealand: *Marine Fish-hatchery and Biological Station at Porto Bello. Record of researches.* Thomson, G. M. 1906.1.

Proposed biological station and fish hatchery near Dunedin. Thomson, G. M. 1898.2, 1901.1.

Fisheries by Subjects

For the commercial utilization of fishes which are only locally important or about which little relating to fisheries has been written, see under such topics as Alewife, Carp, Haddock, Smelt, Tilefish, etc., in regular alphabetical index.

With a few exceptions, all the articles in "The Fisheries and Fishery Industries of the United States," by Goode, G. B. and others (1887.1), which still remains the most comprehensive treatise, have been cited with a star.

ANCHOVY FISHERIES

Anchovy fisheries of the Zuyder Zee in Netherlands. Ehrenbaum, E. 1892.4; Hoek, P. P. 1890.1, 6, 1892.1; ★Redeke, H. C. 1907.2.

Fisheries of Sweden. Ekström, C. U. 1850.1; Lönnberg, A. J. 1894.7, 1900.9.

Fisheries of Finland. Forsberg, A. 1894.1; Forsström, K. 1893.1, 1897.1; Holmberg, H. J. 1859.1; Nordqvist, O. F. 1894.14; Reuter, O. O. 1896.1; Sjöberg, H. R. 1895.1, 1898.1, 1899.2.

Anchovy of Caspian Sea (Text in Russian). Suvorov, E. K. Add. 1913.1.

COD FISHERIES

For further references, see Alaska, Labrador, and Newfoundland, under Canada; and Pacific Coast, under U. S. See also Iceland, and Norway, under Europe. For Cod-liver oil, see above under Economic Products. For papers concerning putrefaction and reddening of cod, see "Red cod," under Preservation, methods, above.

American fisheries: *Chiefly of United States.* Baird, S. F. 1875.1, 1877.7; Butler, J. D. 1897.1; Chadwick, J. 1874.1; Collins, J. W. 1885.4, Add. 1884.3, 1886.2, 1887.1, 1889.2; Cormack, W. E. 1826.1; D., C. U. 1874.1; Earll, R. E. 1880.1; Gilpin, J. B. 1863.1; Goode, G. B. 1878.9; ★Goode, G. B., & Collins, J. W. 1887.1, .2; Habberton, J. 1880.1; Jefferson, T. 1832.1; Mather, F. 1884.2; Mitchill, S. L. 1805.1; Putnam, F. W. 1865.2; Tarr, R. S. 1884.1; Tibbetts, N. V. 1887.1; Winterbotham, W. 1795.1.

History of emblem of codfish in House of Representatives, Boston. Anon. 295.

European fisheries: Andrée, K. 1867.1; Brown, Richard. 1880.1; Coquidé, M. 1909.1; Fluegel, C. G. 1842.1; Gillet de Grandmont, A. 1845.1; Le Timbre, A. M. 1872.1 (*Iceland*); Lindes, L. 1880.9; Littaye, — 1891.1; Lönnberg, A. J. 1895.1, 1897.3 (*Sweden*); McCulloch, J. R. 1869.1; Mohr, N. 1782.1; Reuter, O. O. 1900.1 (*Finland*); Roussel, J. 1900.1; Schneider, G. 1900.6, 1902.4, 1905.13, 1906.7; Skrydstrup, V. 1873.1 (*Denmark*); Soralue y Zubizarreta, N. 1878.1 (*Spain*); V. 1905.1; Winkler, T. C. 1861.3. — *Ireland.* Andrews, W. Add. 1861.1.

EEL FISHERIES

Fisheries of countries of northern Europe. Gilson, G. 1908.1; Limborg, H. 1894.6; ★Petersen, C. G. 1896.1, 1904.1; Saint-Paul, G. D. 1905.1; Snellman, R. W. 1899.1; Stemmann, — 1878.2; Vogel, W. 1893.1; ★Walter, E. 1910.2; Zimmermann, H. 1903.1; Anon. 11, 174, 312, 547.

For the extensive fisheries practised by means of labyrinths in the lagoons of Comacchio, see under Pisciculture, Italy.

FLATFISH FISHERIES

Halibut fisheries of America, chiefly of North Pacific. Alexander, A. B. 1898.1; Broca, P. 1876.1; Collins, J. W. 1883.3; ★Goode, Collins, & Scudder, 1887.1; Krause, — 1882.1 (*Alaska*); McMurrich, J. P. 1913.2; Scudder, N. P. 1887.1; ★Goode, G. B., & Collins, J. W. Add. 1887.1. — *Of Iceland.* Collins, J. W. 1884.4, 1886.1; Thorsteinson, A. 1885.1.

Flounders of California markets. Lockington, W. N. 1879.1, 4, 6.

Plaice, Sole, etc., of Baltic and North Seas. Dampf, — 1908.1; Dobrée, N. F. 1863.1; Duge, F. 1905.1; Franz, V. 1909.2; ★Heincke, F. 1913.1; Heincke, F., & Henking, H. 1908.1; Henking, H. 1911.1; Hoek, P. P. 1908.2; ★Johansen, A. C. 1905.1, 1906.1–1912.1; Lönnberg, A. J. 1894.2; Petersen, C. G. 1894.1, 1897.1, 1899.1, 1901.3, 1909.1, 3; Petersen, Garstang, & Kyle. 1907.1; Pettersson, O., & Schneider, G. 1908.1; Redeke, H. C. 1909.2; Schiodte, J. M. 1868.1, 1877.1; Friis, N. C. Add. 1771.1, 4, 1778.1.

HERRING FISHERIES

For use of young herring as "white-bait," see below under this heading.

Miscellanea

Andrée, K. 1867.1; Bock, F. S. 1769.1; Bonnet, C. 1783.1, 2; Brown, Richard 1880.1; Baird, S. F. 1873.41, 1875.26, 1876.6; ★Caux, J. 1881.1; Dambeck, K. 1881.1; ★Duhamel, H. L. & others, 1803.1; Gevers Deynoot, W. T. 1829.1; Green, H. J. 1883.1; Hartemann, R. 1880.1; Hogarth, R. 1883.1; Johnston, J., & Smith, W. A. 1890.1 (*Branding regulations*); Kamada, T. 1909.1; Kroeff, N. M. 1858.1; La Bavière, — 1872.1; Longuét, L. 1868.1, 1879.1; ★Mitchell, J. M. 1864.1; Möbius, K. A. 1875.3; Munro, R. J. 1883.1; Noël de la Morinière, S. 1789.1; Paulsen, P. G. 1884.1; Raggi, L. 1904.1; ★Smith, H. M. 1909.3; Anon. 178, 286, 620.

Methods of preserving herring. Kopal, G. 1878.1; Longuét, L. 1868.1, 1879.1; Mitchell, J. M. (n. d.); Möller, J. M. 1865.1; Widegren, H. 1872.2, 3, 1876.1. — *Putrefaction during salting caused by crustacean food (Aat.)* Boeck, A. 1866.1, 1868.1; Meier, H. 1869.2.

Preservation practices in the 14th Century. Anon. 14.

America

Canada: *New Brunswick, and Newfoundland.* Baird, S. F. 1874.20; Carroll, M. 1873.1; Kynaston, A. F. 1852.1; Moore, H. F. 1898.1; Moses, H. 1864.1; Prince, E. E. 1916.1.

United States: *New England States.* Bouvé, T. T. 1854.1; Collins, J. W. 1883.4; ★Earll, R. E. 1887.4; G., — von. 1876.5; Grant, I. H. 1883.1; Hall, A. 1898.1.

Frozen herring trade with Canada. Baird, S. F. 1873.48; Wilcox, W. A. 1889.2; Collins, J. Add. 1884.1.

For "herring" of South Atlantic States, see Alewife.

Europe

For a recent treatise on the European herring fisheries, consult Samuel, A. M. "The Herring: its effect on the history of Britain." London, 1918. 199 p. figs.

British Isles: ★Brabazon, W. 1848.1; Gunn, W., & McLeod, M. 1889.1; McCulloch, J. 1823.1; ★Mitchell, J. M. 1864.1; Viennot, T. C. 1863.1.

England. Buckland, F. T. 1875.2; Collins, J. W. 1885.1; Simonsen, C. 1887.1; ★Smith, H. M. 1904.10; Southwell, T. 1879.1, 1883.1; Wigg, T. J. 1906.1, 1910.1; Nall, J. G. Add. 1867.1.

Ireland; Moy Estuary, chiefly. Andrews, W. 1865.3, 1866.1, 1875.1; Barrett-Hamilton, G. 1899.1; Warren, R. 1898.1, 1905.1, 1906.1.

Scotland. Bell, H. 1774.1; Buckland, F., Walpole, S., & Young, A. 1878.1; Duff, R. W. 1883.1; Carr, T. F. 1884.2; Fulton, T. W. 1907.1; Lindeman, M.

Fisheries — Cont'd.

1872.1–1875.1; Logan, G. 1863.1; Miln, W. S. 1883.1,2; Munro, M., & Bill, J. 1860.1; Philips, B. 1878.13; Primrose, B. F. 1852.1; Smith, H. M. 1904.10; Brook, G. Add. 1886.2; Day, F. Add. 1882.1; Campbell, J. Pre-Linn. 1750.1.

Caspian Sea: (*Clupea ponto-caspica*). Lebedintsev, A. A. 1905.2,3; Semenov, N. V. 1902.1; Meissner, A. I. Add. 1914.1.

Denmark: Jensen, O. S. 1880.1, 1883.1; Skrydstrup, V. 1873.1.

Finland: Reuter, O. O. 1900.1; Schneider, G. 1909.10.

France: Cligny, A. 1912.11; Longuét, L. 1860.1, 1868.1, 1878.1, 1879.1; Soubeiran, J. L. 1870.2; Garel, E. Add. 1911.1; Martel, E. Add. 1898.1.

Germany: Andrée, K. 1867.1; Apstein, C., & Hinklemann, A. 1898.1; Bock, F. S. 1769.1; Danziger, C. 1873.1, 1879.3; Freeden, — 1875.1; Groenewold, B. E. 1880.1; Hartemann, R. 1880.1; Henking, H. 1907.1; Herwig, — 1897.1; Kupffer, C. W. 1876.1; Lindeman, M. 1875.2; Münter, J. A. 1863.1; Rensen, P. 1872.1; Schleiden, M. J. 1866.1; Anon. 289, 438, 595; Friis, N. C. Add. 1777.1, 1778.1; Ljungman, A. W. Add. 1880.1; Möbius, K. Add. 1880.1.

Fisheries of Pomerania and Rügen in 12th and 13th Centuries. Sell, J. J. Add. 1797.1, 1831.1.

Iceland: Finn, W. 1880.1, 1882.1; Erichsen, J. Add. 1783.1; J. C. Add. 1885.1.

Netherlands: Danziger, C. 1879.3; Drossaart, P. K. 1868.1; Ehrenbaum, E. 1889.1; Gunn, W., & McLeod, M. G. 1889.1; Hoeven, J. 1852.1; Jonge, D., Kobel, H., & Salieth, M. 1792.1; Parser, M. 1868.1; Rietstap, G. H. 1864.1; Smith, H. M. 1904.10; Soubeiran, J. L. 1873.1; Winkler, T. C. 1852.1; Anon. 13; C., N. Add. 1905.1; Evers, F. S. Add. 1906.1; Freeden, W., Dantziger, C., & Rensen, P. Add. 1871.1.

Pre-Linn. references. Aitzema, L. 1669.1; Burrish, O. 1728.1; Laan, A. 1700.1; Meulen, S. 1700.1; Semeyns, M. 1639.1.

Norway: Andersen, O. 1868.2; Badeigts de Laborde, — 1815.1; Blanchard, C. E. 1882.1; Boeck, A. 1862.1–1875.1; Boeck, A., & Feddersen, J. 1876.1; Broch, H. 1907.1; Broch, O. J. 1882.1; Brunchorst, J. 1889.1; Buch, S. A. 1886.1; Dahl, K. 1909.4; Friis, N. C. 1770.1, Add. 1770.1,2,3,4, 1771.2,3; Heincke, F., & Henking, H. 1900.1; Laing, S. 1851.1; Maude, A. 1859.1; Milne-Edwards, A. 1878.1; Watt, W. 1883.2.

Sweden: *Chiefly Bohuslan fisheries.* Andersen, O. 1868.1,2; Baird, S. F. 1878.4; Boeck, A. 1870.1, 1871.1, 1874.1; Ekström, C. U. 1844.1, 1850.3; Finn, W. 1878.2; Hollberg, L. 1819.1; Lindahl, J. 1879.1; ★Ljungman, A. V. 1874.1–

1886.1, (*Periodicity*) 1879.2, 1882.1, 1885.2; Lönnberg, A. J. 1889.1; Malm, A. H. 1887.1, 1903.1; Malm, A. W. 1861.1, 1880.2; Tomfohrde, T. 1909.1; Watt, W. 1883.2; Widegren, H. 1870.3; Yhlen, G. 1875.1, 1879.2; Anon. 101, 691; Smitt, F. A. Add. 1895.1; Strandberg, O. Add. 1772.1,2; Humble, N. Pre-Linn. 1745.1.

MACKEREL FISHERIES

American fisheries: Baird, S. F. 1877.8; Bean, T. H. 1887.3; Collins, J. W. 1881.2, 1884.5; Cremony, J. C. 1870.1; Gilpin, J. B. 1863.1, 1878.1; Goode, G. B. 1878.10, 1883.2; ★Goode & Collins, 1887.8; ★Goode, Collins, Earll, & Clark, 1884.1; Kendall, W. C. 1910.2; Martin, S. J. 1882.1,12, 1883.2; Philips, B. 1883.1; Rich, S. 1879.1; Smiley, C. W. 1883.5; Wood, Wm. 1873.1. — *Southern spring fishery.* ★Smith, H. M. 1899.8.

European fisheries: *Chiefly of north-western Europe.* Brown, Richard. 1880.1; Cornish, T. 1876.1, 1880.2, 1881.2, 1883.2, 1891.1; Gauss-Garady, V. 1909.1; Lönnberg, A. J. 1911.4; Marion, A. F. 1894.6 (*Marseilles, France*); Pozniakov, A. 1908.1; Rietstap, G. H. 1870.1; Willumsen, P. J. 1882.1; Anon. 352; ★Ehrenbaum, E. Add. 1914.2.

British Isles: *Chiefly England.* Allen, E. J. 1909.1; Bullen, G. E. 1908.1, 1913.1; Calderwood, W. L. 1891.1; Collins, J. W. 1885.1; Couch, J. 1844.2; Green, W. S. 1894.1 (*Ireland*); Ridge, R. J. 1889.1; Scott, A. 1914.1.

Spanish mackerel: *Origin and development of fisheries.* Earll, R. E. 1883.2, 1887.9.

MENHADEN FISHERIES

For the use of menhaden for fertilizer and oil, see above under Economic products.

American menhaden industry. De Blois, E. T. 1882.1; Friedländer, O. O. 1883.1, Add. 1883.1; ★Goode, G. B. 1879.7, 1882.3; ★Goode & Atwater, 1880.1; ★Goode & Clark, 1887.1; Hathaway, W. E. 1908.1; Hawkins, J. W. 1882.1; Kendall, W. C. 1910.2; Mosher, G. 1882.1; Smith, H. M. 1896.1; Varigny, H. C. 1894.1; Maddocks, L. Add. 1878.1.

For many items entitled "Statement concerning the menhaden fishery," and listed under individual authors, see Rept. U. S. Fish. Comm. 1877 (1879), vol. V.

MULLET FISHERIES

Chiefly South Atlantic States of United States. Baird, S. F. 1877.9; Kishinouye, K. 1898.3 (*Japan*); Philips, B. 1884.2; Symons, J. 1874.1 (*Cornwall, Eng.*); Yarrow, H. C. 1874.1; ★Earll, R. E. Add. 1889.1.

Botargo, salted mullet roe. Armand, B. 1897.1; Wallut, C. 1863.1.

PILCHARD, See SARDINE**RED SNAPPER FISHERIES**

Chiefly of Gulf of Mexico, around Cuba and Florida. Collins, J. W. 1885.2, 1887.3, .4; Garcia Canizares, F. 1911.1; ★Stearns, S. 1887.3; Warren, A. F. Add. 1898.1.

SALMON FISHERIES

For treatises on the salmon as a game fish, *see under* Angling. For life-histories, habits, etc., *see* Salmonidæ.

America

A most readable and comprehensive treatise is the "Pacific Salmon Fisheries" by ★J. N. Cobb, published as Append. I to the Rept. U. S. Comm. Fisheries, 1921 (Bur. Fish. Doc. No. 902), 268 p., 48 figs.

Alaska: ★Bean, T. H. 1890.26a, 1891.18, 1894.1; Cobb, J. N. 1905.2, 1910.1; James, B. W. 1893.1; Jordan, D. S., & Evermann, B. W. 1904.3; Kutchin, H. M. 1899.1, 1907.1; McDonald, M. 1894.2; ★Moser, J. F. 1899.1, 1902.1; Tingle, G. R. 1897.1; Zur Mühlen, M. 1911.1.

California: *Chiefly Sacramento River.* Baird, S. F. 1875.32, 33; Dall, W. H. 1883.1; Kirkpatrick, C. A. 1860.1; Redding, J. D. 1889.1; Serre, P. 1899.1; Stone, L. 1874.7; Jordan, D., & Gilbert, C. Add. 1887.1.

First salmon cannery established at Sacramento, Cal., in 1864 by Wm. Hume, G. W. Hume, and A. S. Hapgood. Adams, E. H. Add. 1885.1; Hume, R. D. Add. 1904.1.

Columbia River: *Oregon and Washington.* A. 1874.2; Baird, S. F. 1875.23; Barin, L. T. 1886.1; Carll, W. E. 1904.1; ★Cobb, J. N. 1911.1; Cox, R. 1831.1; Dawson, G. M. 1879.1; ★Evermann, B. W., & Meek, S. E. 1898.1; Franchère, G. 1820.1, 1854.1; Gilbert, C. H. 1912.2; ★Gilbert, C. H., & Evermann, B. W. 1894.1; Green, L. W. 1887.1, 2; Grover, G. 1874.1; McDonald, M. 1895.3, 4; Mather, F. 1878.5, 6; Nordhoff, C. 1874.1; Rockwell, C. 1875.1; Smith, C. J. 1880.2; Stone, L. 1878.4, 1889.1; Swan, J. G. 1857.1; Wilcox, W. A. 1898.2, 1902.1; Willey, D. A. 1905.1; Abernethy, A. S. Add. 1886.1; Buschman, C. H. Add. 1914.2; Herbert, M. J. Add. 1914.1; ★Jordan, D. S., & Gilbert, C. H. Add. 1887.1.

Penobscot River: *Maine.* Atkins, C. G. 1868.1–1912.1; Evermann, B. W. 1905.9; Hamlin, A. C. 1874.1; Lincoln, T. 1874.1; Smith, H. M. 1898.5; Wood, Wm. 1873.1.

Asia

Siberia: *Amur River.* Zur Mühlen, M. 1911.12.

Europe

British Isles: *General and including England.* Ashworth, T. 1868.1; Cornish,

J. 1824.1; Fryer, C. E. 1883.3; Home, D. M. 1884.1; Hutchinson, H. G. 1900.1; Jardine, W. 1862.1; Russel, A. 1864.2; Anon. 301, 637.

Ireland. Andrews, W. 1863.1, 1864.2, 1865.1; Blake, J. A. 1863.1; Holt, E. W. 1902.1, 1905.2, 3; Joynt, A. 1862.1; Reeves, R. W. 1866.1; Shiel, J. B. 1842.1; Anon. 483, 516, 527; Marin, G. Add. 1779.1.

Scotland. Buckland, F. T., & Young, A. 1871.1; Calderwood, W. L. 1900.1, 1904.6, 1912.1, 1913.1, Add. 1889.1, 1914.1; Home, D. M. 1882.1; Jopp, A. 1860.1; Mackenzie, M. 1860.1; Tosh, J. R. 1895.1; Walpole, S., & Young, A. 1881.1; Anon. 425, 431, 437, 484, 597, 710; Archer, W. E. Add. 1893.2.

Continental Europe:

Denmark. Feddersen, A. F. 1870.1; Skrydstrup, V. 1875.1.

France. Bénardeau, F. 1905.1; Bureau, L. 1891.1; David, — 1896.1.

Germany. Häpke, L. 1876.1–1913.1; Hoek, P. 1910.2; Hoek, P., & Trybom, F. 1907.1; Seidlitz, G. 1877.2; Stemmann, — 1894.1; Trybom, F. 1910.1; Gissler, N. Pre-Linn. 1751.1.

Netherlands. Hoek, P. 1894.4; Quakernaat van Spijk, A. 1870.1, 1871.1; Roché, G. 1895.1.

Norway. Berthoule, A., & Vaillant, L. 1889.1; Dahl, K. 1909.4; Hetting, M. G. 1866.3, 1868.2, 1869.1; Maude, A. 1859.1.

Russia: Finland, Lapland, etc. Nordqvist, O. F. 1894.7, 1898.6, 1899.10; Oehberg, A. 1897.1; Räihä, — 1893.1; Sandman, J. A. 1892.3–1900.1; Hallström, G. Add. 1911.1.

Spain. Nava y Caveda, H. 1878.1.

Sweden. Hetting, M. G. 1866.3; Trybom, F. 1887.2; Wollebaek, A. 1904.1; Marin, G. Add. 1774.1, 1778.1.

Switzerland. Fankhauser, F. 1906.1; Matthey, L. 1880.2; Plattner, S. 1879.1.

SARDINE FISHERIES

Methods of preservation. Castillo, L. 1912.5; Müller, C. 1909.1; Pérard, J. Add. 1913.1.

Roe (Rogue), used as bait; preparation and use in Sardine Fisheries. Cépède, C. 1910.4; Landrieu, G. 1904.1; Smith, H. M. 1902.4. — *French imports in 1881.* Paulsen, P. G. 1884.1.

France: *Chiefly coast of Brittany.* Baudouin, M. 1888.1; Blavier, A. 1882.1; Caillou, — 1855.1; Delidon, E. S. 1866.1, 1869.1; Fabre-Domergue, P. 1897.1, 1913.1, Add. 1913.1; Gifford, G. 1883.1; Künstler, J. 1903.1; Launette, P. 1882.1, Add. 1887.1; Odin, A. 1896.1; Peyron, S. 1864.1; Pouchet, G. 1886.1–1891.3; ★Smith, H. M. 1902.4, 1904.3, 1909.1; Vauvert, M. 1870.1; Anon. 700; Berthoule, A. Add. 1887.1; Bouvier-Lapierre, E. Add. 1887.1; Cligny, A. (*Bibliography*) Add. 1913.2, 1914.2; Rodel, A. Add. 1913.1; Deslandes, A. F. Pre-Linn. 1727.1.

Fisheries — Cont'd.

Other European countries: *Spain.* Albert I, H. C. 1887.2; Cornide, J. 1774.1; Smith, W. A. 1891.1. — *Norway.* Hjort, J. 1913.1. — *Portugal.* Nobre, A. 1895.2, .3. — *Finland.* Arvelin, J. E. Add. 1893.2

English pilchard fisheries: *Adult form of the sardine.* Bolitho, T. S. 1851.1, 1864.1; Chester, J. 1835.1; Cornish, T. 1883.2; Couch, J. 1835.1, 1840.1; Courtenay, J. S. 1840.1; Fox, Howard, 1885.1; Roberts, W. (1815-1871) 1871.1; Roach, W. 1889.1; ★Wilcocks, J. C. 1883.2; Collins, W. Add. 1851.1; Swithinbank, H., & Bullen, G. E. Add. 1913.1, 1914.1.

American Industry: *Young herring canned as sardines.* Bensley, B. A. 1902.1; Brevoort, J. C. 1873.1; ★Earll, R. E. 1887.4; Earll, R. E., & Smith, H. M. 1889.1.

SHAD FISHERIES

Chiefly of South Atlantic States of U. S.; Delaware, Potomac and Susquehanna Rivers. Atkins, C. G. 1887.2 (Maine); Blackford, E. G. 1879.2, 1884.1, 1887.1; Boyer, J. 1909.1; Chalker, R. B. (Connecticut) 1887.1, .2; 1889.1; Cobb, J. N. 1906.3; Ferguson, T. B. 1884.1; Goode, G. B. 1874.4; Hallock, C. 1895.1; Harris, G. 1884.1, .2, 1885.1, 1887.1; Howell, S. 1837.1; Huske, C. J. 1884.3; Lennurt, J. T. 1883.1; McDonald, M. 1884.5; Mather, F. 1885.4 (Hudson R.); Osborn, J. H. 1882.1, 1883.1; Smiley, C. W. 1883.12, 1884.10; Smith, H. M. 1906.1; Willis, H. 1882.1; Wood, W. M. 1884.1, .2; Wright, H. 1884.1, Add. 1882.1; Yarrow, H. C. 1874.1, .2, .5; Milner, J. W. Add. 1882.1; Stevenson, C. H. Add. 1899.2.

Shad fisheries of the Pacific coast. (The shad was introduced into the Sacramento River in 1871.) Smith, H. M. 1896.3; Wilcox, W. A. 1898.2, 1902.1, 1906.1.

SPRAT FISHERIES

Chiefly North Sea fisheries around Norway and Scotland. Ehrenbaum, E. 1910.4; Fletcher, J. 1905.1, 1906.1; Koefoed, E. 1909.1; Logan, G. 1863.1, .2; ★Lund, O. 1910.1; Martin, W. 1862.1; Matthews, J. D. 1884.1; Redeke, H. C. 1900.3, 1910.1 (Netherlands); Sars, G. O. 1894.1 (Norway); Schneider, G. 1910.2; Anon. 595. — *Finland.* Arvelin, J. E. Add. 1893.1-1894.1. — *Spain.* Fernandez, C. Add. 1850.1.

STURGEON FISHERIES

France. Roule, L. 1905.3.

Germany. Boettger, O. 1871.1; Noll, F. C. 1871.1; Quamtz, H. 1903.1; Schneider, O. 1879.1; Stemmann, — 1894.1; W. 1896.1.

Russia. Baženov, A. 1906.1; Borodin, N. A. 1897.1, 1901.2; Kavraiskii, T. T. 1907.1; Nordqvist, O. F. 1896.7; Saurén, H. 1895.1; Savostickij, N. G. 1901.1; Tichij, M. 1912.2; Wetterich, A. 1880.1 (Siberia); Wight, J. 1901.1.

United States. Cobb, J. N. 1900.2; Hovey, H. C. 1884.1; Kalm, P. 1761.1; ★Ryder, J. A. 1890.4; Stockwell, G. A. 1875.1, 1883.1; Tower, W. S. 1908.1; Meehan, W. E. Add. 1899.1; Smith, H. M. Add. 1913.3.

"Spoonbill sturgeon" (*Polyodon*), *caviar industry of lower Mississippi.* Husakof, L. 1910.5, 1911.3.

Caviar industry of Canada. Prince, E. Add. 1905.1.

TUNNY FISHERIES

Mediterranean fisheries, chiefly about coasts of Italy and Sicily. Hintze, A. 1884.2; Muth, J. P. 1869.1; ★Pavesi, P. 1889.1; Raggi, G. A. 1894.1; Russo, A. 1913.1; Turrel, L. 1872.2, 1875.1, 1877.1; Anon. 528; Amico, F. C. Add. 1816.1; Bounhiol, J. P. Add. 1911.1; Brydone, P. Add. 1806.1; Galliani, A. Add. 1903.1.

WHITEBAIT

Considered young of Allis shad. Donovan, E. 1802.1.

Considered a separate species, Clupea alba Yarrell. Cuvier, G., & Valenciennes, A. 1848.1; Lawson, H. 1865.1; Lord, J. K. 1870.1; Parnell, R. 1832.4, 1837.2, 1839.4; Yarrell, W. 1829.1.

First demonstration by Günther of identity with young herring (C. harengus). Günther, A. 1868.5; Tegetmeier, W. B. 1868.1; Anon. 629.

American and English Whitebait, i. e. young herring. Blackford, E. G. 1878.1, 1879.4, .5, 1880.2; Brevoort, J. C. 1873.5; Day, F. 1879.5; Ewart, J. C. 1888.6; Scott, A. 1915.2; Sim, G. 1883.2; Ewart, J. C., & Matthews, J. D. Add. 1886.1.

Composition of Whitebait at Nice, France; young of Alosa, Aphyia, Mugil, Smaris, Gobius, etc. Pellegrin, J. 1904.11.

New Zealand Whitebait, composed of young Galaxias. Gibson, E. 1903.1; MacKenzie, A. J. 1903.1; Powell, L. 1870.1.

WHITEFISH FISHERIES

Great Lakes Whitefish industry of America. Barnston, G. 1874.1; Gauthier, C. W. 1911.1; ★Geare, R. I. 1884.1; Kerr, J. W. 1874.1; Kiel, P. 1874.1; Stockwell, G. A. 1875.3; Wilson, C. H. 1913.1; Anon. 148, 630. Patton, M. F. Add. 1912.1; Smith, R. Add. 1908.1.

European Whitefishes; (Maraena, Felchen, Renke, etc.). Austria. Clodi, E. 1911.1. — *Scotland.* Cowe, R. 1834.1. — *Germany.* Borne, M. 1880.3; Dallmer, E. 1878.3; Einfeld, H. 1880.1; Halbfass, W. 1901.1; Leonhardt, E. E. 1903.9; Max, C. 1911.1; Seidlitz, G. 1879.1; Skowronnek, F. 1912.1; Wengen, — 1878.2. — *Switzerland.* Lankester, E. R. 1912.1; Surbeck, G. 1914.1, 1915.1. — *Finland.* Nordqvist, O. F. 1897.6, 1898.3, 1900.13. — *Norway.* Friis, N. C. Add. 1771.2, .3, 1778.1.

Fisheries Arranged Geographically**AFRICA**

General: Adam, V. 1839.1; Puente y Olca, P. 1885.1.

East Coast; Indian O. and Red Sea. Alluaud, C. 1904.1; Endicott, C. 1887.1; Klunzinger, C. B. 1871.3; Merle, A. 1879.1; Anon. 684.

West coast or Atlantic fisheries. Aube, F. 1872.1; Band, H. 1879.1; Berthelot, S. 1840.1; Gruvel, A., & Bouyat, A. 1906.1; Robertson, G. A. 1819.1; Schultze, L. S. 1907.1; Stassano, E. 1890.1; Berthoule, A. Add. 1888.1; D., G. Add. 1905.1.

French Colonies, fisheries. Darboux, G., Stephan, P., Cotte, J., & Gaver, F. Add. 1907.1; Pellegrin, J. 1906.6, 1909.11; Regelsperger, G. 1905.1.

Algeria: Bonnard, A. 1902.1; Bounhiol, J. P. 1907.1, 1908.1; ★Bourjot, A. 1869.1; ★Bouchon-Brandely, G. J., & Berthoule, A. 1891.1; Cacheux, E. 1903.1; Cépède, C. 1907.5; Chudeau, R. 1905.1; Layre, — 1899.1; Peixotto, B. F. 1884.1; Perissat, G. 1889.1.

Canary Is.: Puente y Olca, P. 1885.1; Taquin, A. 1902.1.

Cape Colony: Gilchrist, J. D. Add. 1914.3; Jardine, A. J. 1830.1; Siler, J. W. 1885.1. — *Cape of Good Hope.* Schultze, L. S. 1907.1; Kolbe, P. Pre-Linn. 1731.1.

Cape Verde Is.: Cardoso, J. 1895.1.

Egypt: ★Mitchell, J. C. 1895.1–1898.1. — *Nile R.* Werner, Franz, 1906.2.

Guinea: Gold Coast. Moloney, C. A. 1883.1; Müller, W. J. Pre-Linn. 1675.1.

Kamerun: Ehrenbaum, E. Add. 1914.7; Anon. 669, 707.

Kongo, Belgian: Goffin, A. 1909.1; Wilverth, E. 1897.1, 1911.1.

Madeira Is.: Syle, L. D. 1885.1.

Senegal: Gruvel, A. 1905.1, 1908.1, 1911.1, Add. 1913.1; Hautreux, J. A. Add. 1888.1.

Tunis. ★Bouchon-Brandely, G. J. B. & Berthoule, A. 1891.1; Espitallier, G. Add. 1901.1; Fages, E., & Ponzevra, C. Add. 1908.1.

AMERICA**NORTH AMERICA****ALASKA**

General: ★Bean, T. H. 1887.8, 1889.5; ★Cobb, J. N. 1905.2, 1906.1, 1907.2, 1911.1, Add. 1914.2; ★Dall, W. H. 1870.1, 1871.1; ★Evermann, B. W. 1911.1–1913.1, 1914.1, Add. 1911.1; Goode, G. B. 1881.8; James, B. W. 1895.1; H., A. R. 1879.1; Marsh, M. C., & Cobb, J. N. 1908.1; Murdoch, J. 1885.1 (*Point Barrow*); R., H. A. 1879.1; Tanner, Z. L. 1890.1, 1891.1; Bower, W. T. Add. 1914.1; Bower & Fassett, H. C. Add. 1914.1; Chamberlain, F. M., & Bower, W. T. Add. 1913.1.

Cod fisheries. Baird, S. F. 1871.9, 1874.1; Bean, T. H. 1887.2; Krause, — 1882.1; Lockington, W. N. 1879.5.

For salmon fisheries of Alaska, see under Fisheries, Salmon.

CANADA

Publications of the *Department of Marine and Fisheries* are the *Annual Reports*, published at Ottawa.

Miscellaneous papers

Bensley, B. A. 1902.1; Buckingham, J. S. 1843.1; Carpenter, W. B. 1878.1; Finn, W. 1878.1; Goode, G. B. 1883.12; Jagor, A. F. 1873.1; Joncas, L. Z. 1883.1–1894.1; Lindeman, M. 1877.1; McGrath, P. T. 1898.1–1906.1; MacGregor, J. 1847.1; Prince, E. E. 1909.1, 1910.1, 1916.1, 3, Add. 1905.1; Raveret-Wattel, C. 1874.3; Scudder, N. P. 1883.1; Anon. 140, 495.

For references to the N. Atlantic Fisheries Dispute with the U. S., see Legislation & Protection above.

British Columbia: Gilbert, C. H. 1912.2 (*Fraser R., salmon*); Gosnell, R. E. 1897.1; Green, A. 1891.1; Macfie, M. 1865.1; McMurrich, J. P. 1913.3; Mooney, G. S. 1861.1, 2; Rattray, A. 1862.1; Tissandier, A. 1895.1; Babcock, J. P. Add. 1903.1, 1904.1; Bowser, W. J. Add. 1914.1; Rathbun, R. Add. 1900.1. — *Vancouver I.* Bogge, E. B. 1870.1; Macfie, M. 1865.1; Rattray, A. 1862.1; Edge-Partington, J. Add. 1900.1.

Labrador: Chiefly cod fisheries. Browne, P. W. 1900.1; Cartwright, G. 1792.1; ★Goode, G. B., & Collins, J. W. 1887.7; Hallock, C. 1861.1, 1881.1; Hayward, J. S. 1883.1; Marre, F. 1910.1; Martin, M. 1834.1; ★Stearns, W. A. 1885.1; Grenfell, W. T. Add. 1910.1.

New Brunswick: Fairbanks, J. E. 1851.1; Kynaston, A. F. 1852.1; Moore, H. F. 1898.1; Perley, M. H. 1850.1, 1852.2, 3; Semmens, J. M. 1910.1.

Newfoundland: Chiefly cod-fisheries off Grand Banks. Baird, S. F. 1874.20; Bellet, A. 1902.1; Carroll, M. 1873.1; Cunningham, J. T. 1895.8; Dambeck, K. 1876.1; Ehrenbaum, E. 1904.2; Filteau, A. 1850.1 (*Saint Pierre and Miquelon Is.*); Finn, W. 1879.3; Harvey, M. 1883.1; Hayward, J. S. 1883.1; Hearn, W. R. 1899.1; Jukes, J. B. 1853.1; McGrath, P. T. 1898.1–1906.1; Martin, M. 1834.1; Osborn, H. L. 1881.1; Page, F. R. 1860.1; Pedley, C. 1863.1; Phelps, S. 1818.1; Shea, A. 1883.1; Williams, G. 1766.1; Yeats, J. 1870.1; Collins, J. A. Add. 1885.2; Einarssyn, B. Add. 1783.1.

Early references in Pre-Linn. section. Denys, N. 1672.1; Whitbourne, R. 1622.1; Williams, G. 1705.1.

Statistics may be found in the Annual Report of the Department of Marine and Fisheries, published at St. Johns.

Fisheries — Cont'd.

Nova Scotia: Ambrose, J. 1867.1, 1868.1; Frye, W. G. 1885.1; ★Gilpin, J. B. 1863.1; Goode, G. B. 1877.4; Haliburton, T. C. 1829.1; Johnson, E. 1885.1; ★Knight, T. F. 1867.1; Perley, M. H. 1850.2, 1851.2; Reid, A. P. 1877.1. — *Georges Bank, cod.* Goode, G. B., & Collins, J. W. 1887.4.

Ontario: *Repts. Dept. Marine and Fisheries.* Halkett, A. 1905.3, 1907.1, 1910.2; Wright, R. R. Add. 1892.1.

Prince Edward I.: Carbonell, E. T. 1911.1.

Quebec: Holt, G. H. 1885.1; Kalm, P. 1761.1; McDougall, W. 1863.1; Vibert, P. 1879.1.

St. Lawrence R. and Gulf: Cobb, J. N. 1900.1; Fortin, P. 1863.1; ★Goode, G. B., & Collins, J. W. 1887.7 (*Cod*); ★Nettle, R. 1857.1 (*Salmon*); Perley, M. H. 1850.1, 1859.1; Whiteaves, J. F. Add. 1873.1, 1874.1.

GREAT LAKES

Problem of proper jurisdiction over these fisheries. Bean, T. H. 1891.8; Evans, A. K. 1908.1; Joslyn, C. D. 1906.1.

Work of the International Commission. Jordan, D. S. Add. 1910.1; Rathbun, R., & Wakeham, W. Add. 1897.1.

Papers and works relating to Great Lakes in general. Alexander, A. B. 1905.1, 2; Ball, W. H. 1881.1; Bean, T. H. 1892.5; Bissell, J. H. 1889.1; ★Geare, R. I. 1884.1 (*Whitefish*); Kerr, J. W. 1874.1 (*Whitefish*); ★Kumlien, T. L. 1887.1; ★Kumlien, T. L., & True, F. W. 1887.1; Milner, J. W. 1874.5; ★Smith, H. M. 1894.3; Smith, H. M., & Snell, M. 1891.1; Sterling, E. 1884.1; Stockwell, G. A. 1875.1, 2, 3, 1876.1, 1883.1; ★True, F. W. 1887.1; Whitaker, H. 1893.1, Add. 1892.1.

Lake Erie. Cobb, J. N. 1900.1; Keyes, C. M. 1894.1; Nordqvist, O. F. 1894.4; Fleeharty, J. Add. 1897.1; Meehan, W. E. Add. 1902.2.

Lake Ontario. Cobb, J. N. 1898.1, 1900.1; Smith, H. M. 1892.2.

Lake Superior. Tomlin, W. D. 1888.1.

GREENLAND

General treatises. ★Etzel, A. 1860.1; Jonge, J. C. 1862.1. — *Other papers.* Fabricius, O. 1809.1; Jensen, A. S. 1907.1–1910.1; Lindeman, M. 1870.1; Rink, H. J. 1877.1; Zeno, N., & Zeno, A. 1810.1; Cranz, D. Add. 1765.1–1767.2. — *Pre-Linn. refs.* Magnus, O. 1555.1; Zörgdrager, C. G. 1720.1.

UNITED STATES

Much information concerning commercial fisheries in the United States will be found in the *Fishing Gazette*, a monthly journal established in 1884 and published in New York City.

General treatises

The fisheries and fishery industries of the United States, 2 vols. ★Goode & others. 1887.1.

Other general treatises. Geare, R. I. 1884.2; Goode, G. B. 1883.13, Add. 1883.1; Révoil, B. H. 1863.1, 1869.1; ★Sabine, L. 1853.1; Wallem, F. M. 1878.1, 1880.2; Baird, S. F. Add. 1889.1. — *A review of the foreign fishery trade.* ★Stevenson, C. H. Add. 1896.1. — *Popular article.* ★Smith, H. M. 1916.1.

American Fisheries Society

Organized Dec. 20, 1870, in New York City as American Fish Culturists' Assoc. Name changed to Amer. Fish Cultural Assoc. in 1878. Reorganized as American Fisheries Society at 14th Annual Meeting, May 5, 1885, in Washington, D. C.

Notes; origin, history, etc. Bean, B. A. 1891.1; Bean, T. H. 1890.2, 1892.1; Cheney, A. N. 1892.1; Mather, F. 1891.1; Stone, L. 1899.1; Anon. 537; Bower, W. T. Add. 1911.1.

Papers relating to Fish Culturists Association. Baird, S. F. 1872.10; Clift, (Rev.) W. 1874.2; Mather, F. 1880.3.

Bureau of Fisheries

(Before 1903, U. S. Fish Commission.)

Publications of the Bureau are the annual octavo volume known as the *Commissioner's Report* (1st Report, 1871–72, Washington, 1873), since 1905 mainly administrative, and the *Bulletin*, begun in 1881. The latter contains most important technical researches.

Activities, establishment, operations, organization, etc. Baird, S. F. 1871.10, 1876.28, 1879.8; Bean, T. H. 1890.40, 1911.22, Add. 1896.3; Goode, G. B. 1883.13, 1886.1, 1887.1; ★Smith, H. M. 1910.2. — *Results of first decade.* Goode, G. B. 1880.8, 10. — *Organization and personnel.* Smiley, C. W. 1883.11. — *Scope of work*, 1910. Johnson, R. S. Add. 1911.1. *Popular accounts regarding its work.* Evermann, B. W. 1894.5, 1901.3, 1904.2, 8; Goode, G. B. 1874.6–11; Wyckoff, W. C. 1874.1.

Bibliographies: *Lists of publications from 1871–1896.* Scudder, C. W. 1896.1; Smiley, C. W. 1882.2, 1883.9.

See also "An analytical subject bibliography . . . 1871–1920," by ★Rose M. E. MacDonald. *Append. V. to Rept. U. S. Comm. Fisheries*, 1920. 306 p.

Reports of Commissioners: Baird, S. F. 1874.27, 1876.29, 1878.7, 1879.10, 1880.8, 1882.1, 1883.1, 1884.1, 2, Add. 1883.3; Bowers, G. M. 1899.1; Brice, J. J. 1898.3, 4; McDonald, M. 1890.1–1894.1, 1895.2, Add. 1896.1, 2; Smith, H. M. Add. 1914.3. — *List of published reports.* Smiley, C. W. Add. 1883.1.

Work of various U. S. F. C. Steamers: "Albatross," *scientific results of dredging operations on west coast of Central America, off Galapagos Is., and in tropical*

Pacific. Agassiz, A. 1892.2; Eastman, C. R. (*Sharks teeth*) 1903.6, 1906.3; Garman, S. 1899.1; Gilbert, C. H. 1890.3, 1892.2, 1895.1, 1897.1, 1899.2, 1908.1; Goode, G. B., & Bean, T. H. 1894.1, 2, 3, 1896.1. — *Reports on operations, popular accounts of work, etc.* Alexander, A. B. 1902.1; Bowers, G. M. 1905.2, Add. 1912.1; Evermann, B. W. 1892.3; Tanner, Z. L. 1884.3–1894.1; Washburn, F. L. 1887.1; Rathbun, R. Add. 1894.1. — *Construction, equipment, etc.* Tanner, Z. L. 1884.3, 1885.1–1894.1. — *Bibliography relative to work.* Townsend, C. H. 1901.1.

"Fishhawk," *collections, operations, etc.* Goode, G. B., & Bean, T. H. 1896.1; Smith, J. A. 1887.1, 1889.1, 2, 4; Tanner, Z. L. 1883.2, 1884.1, 2; Wood, W. M. 1884.1, 2, 3, 4, 1885.1, 1886.1.

"Grampus" (*Schooner*), *reports of operations.* Bean, T. H. 1887.3; Collins, J. W. 1889.2; Collins & Collins, 1891.1.

"Halcyon," *activities*, 1886. Smith, J. A. 1889.3.

"Lookout," *reports of operations.* Smith, J. A. 1885.1, 1886.1, 1887.2, 3, 1889.5; Wood, W. M. 1884.6.

"Speedwell," *operations in 1879.* Tanner, Z. L. 1882.1.

Depletion of fishery resources

Causes and suggested means for conservation. Bower, S. Add. 1911.1; Collins, A. S. 1875.1 (*brook-trout*); Curtis, G. C. 1912.1; Spangler, A. M. 1894.1.

Legislation

Nationalism in state fisheries. Chamberlayne, F. M. 1893.1, 1895.1; Hinrichs, H. 1913.1; James, B. W. 1896.1–1902.1. — *State control of fisheries.* Bryant, E. E. 1902.1; Post, H. 1893.1; Titcomb, J. W. 1899.1. — *Legislation before 59th Congress.* Smith, H. M. 1906.2. — *Reports of state commissions with regard to regulation of sea-fisheries.* Anon. 470.

New England Fisheries

General and historical accounts. ★Clark, A. H. 1887.4; ★McFarland, R. 1911.1; Smith, (Capt.) J. 1865.1, Pre-Linn. 1622.1; Weeden, W. B. 1890.1; Williams, R. 1873.1; Winthrop, J. 1825.1; Wood, Wm. 1873.1; Woodbury, C. L. 1880.1.

Former abundance of fishes on the New England Coast. Baird, S. F. 1872.21, 1874.18, 1875.37; Broadhead, J. M. 1873.1; Deane, S. 1873.1; Higginson, F. 1873.1; Macy, Z. 1873.1.

Various papers. Albro, S. 1873.1; Baird, S. F. 1873.28, 42, 44, 50; C., W. H. 1878.1; Collins, J. W. 1883.8, Add. 1884.2; Collins & Smith, H. M. 1892.1; Douglass, W. 1760.1; Folger, W. 1794.1; Hubbard, W. 1815.1; McGrath, P. T. 1898.1–1906.1; MacPherson, D. 1805.1; Macy, O. 1835.1; Pagenstecher, H. A. 1875.2, 1876.1; Prince, T. 1826.1; Ricketson, D. 1858.1; Wilcox, W. A. 1885.1, 1887.3.

Pacific Coast Fisheries

General. Cobb, J. N. Add. 1914.1, 3, 4, 5; Collins, J. W. 1892.2, Add. 1892.1; Jordan, D. S. 1887.2; Wilcox, W. A. Add. 1895.1. — *Activities of the Bureau of Fisheries on Pacific Coast.* Alexander, A. B. 1898.1, 1912.1; Bower, W. T. Add. 1912.1; Smith, H. M. 1895.1, 1915.1, Add. 1914.2. — *Pacific Fisheries Society, organization.* Westerfeld, C. 1915.1. — *Cod fisheries.* Overton, C. P. Add. 1906.1; Scammon, C. M. 1870.1. — *For Pacific coast salmon fisheries, see Fisheries, Salmon.*

Statistics

Alexander, A. B. 1905.1, 2, 3, 4, 5; Baird, S. F. 1877.6, 1878.3; Evermann, B. W. 1904.1 (*Middle Atlantic states*); Goode, G. B. 1877.4, 1880.18; Hall, A. A. 1850.1 (*Importations, 1829–1848*); Smiley, C. W. 1883.4; Smith, H. M. 1893.2, 1894.6, 1895.4, 1898.6; Stevenson, C. H. 1910.1; Townsend, C. H. 1904.1.

Statistics of interior fisheries, comprising among other states, Idaho, Indiana, Kentucky, Minnesota, Missouri, Nebraska, Nevada, South Dakota, and West Virginia. ★Smith, H. M. 1898.6.

Miscellaneous papers

Bean, B. A. 1887.3, 1892.2; Borne, M. 1875.4; Bourne, G. C. 1889.1; Ehrenbaum, E. 1894.1; Fuhrmann, O. 1908.1; Goode, G. B. 1883.2, 3; Goode, & Collins, J. W. 1887.8; Guthrie, — 1815.1; Hovey, H. C. 1879.1; Kershaw, F. W. 1912.1; MacGregor, J. 1847.1; Martin, S. J. 1882.12, 1883.2; Marvin, W. L. 1902.1; Nordqvist, O. F. 1893.1, 2, 3; Rathbun, R. 1893.1, 1898.1, Add. 1892.1, 1895.1, 1896.1; Reichard, A. C. 1904.1; Rich, S. 1879.1; Serre, P. 1899.2; Smiley, C. W. 1883.5; Smith, H. M. 1899.8, 1900.2, 1902.12, Add. 1914.1; Tucker, J. R. 1887.1. — *Comparison of American and French fisheries.* Baird, S. F. 1872.7. — *Principal river fisheries.* Smiley, C. W. 1885.3. — *Trade relations with Japan.* Smith, H. M. 1905.8, Add. 1905.3.

Alabama: *Statistics.* Alexander, A. B. 1905.3; Collins, J. W., & Smith, H. M. 1893.1; Smith, H. M. 1893.2, 1898.6. — *Coosa R.* Smiley, C. W. 1883.12.

California: Borne, M. 1878.9; Dall, W. H. 1884.1; Eigenmann, C. H. 1890.5; Goode, G. B. 1881.8; Hittel, J. 1863.1; Hooper, E. J. 1876.2; Jordan, D. S. 1892.1; ★Jordan & Gilbert, 1888.2; Kirkpatrick, C. A. 1860.1; Lockington, W. N. 1879.1, 10, 1880.9, 18; Redding, B. B. 1876.1; Redding, J. D. 1889.1; Serre, P. 1899.1; Smith, H. M. 1898.6; Stone, L. 1874.7, 1876.3; Tanner, Z. L. 1893.1; Throckmorton, S. R., Redding, & Farwell, 1874.1; Wilcox, W. A. 1898.2, 1902.1, 1906.1; Holder, C. F. Add. 1914.1.

For the extensive salmon fisheries of the Sacramento, see above.

Colorado: Evermann, B. W. 1905.9.

Fisheries — *Cont'd.*

Connecticut: Alexander, A. B. 1905.4; Baird, S. F. 1871.37; Chalker, R. B. 1887.1, 2, 1889.1; ★Clark, A. H. 1887.1; DeForest, J. W. 1851.1; Hudson, W. M., Pike, R. G., & Bill, J. A. 1872.1, 1873.1; McDonald, M. 1887.4.

Delaware: Collins, J. W. 1887.1, 5. — *Delaware R.* Cobb, J. N. 1900.2; Howell, S. 1837.1.

Florida: Adams, A. C., & Kendall, W. C. 1891.1; Alexander, A. B. 1905.3, 5; Cobb, J. N. 1898.2; Collins, J. W. 1885.2, 1887.4; Collins, & Smith, H. M. 1893.1; Earll, R. E. 1887.2; Fisher, F. B. 1882.1; Gamgee, J. 1880.1; McDonald, M. 1887.7; Osborn, J. H. 1882.1, 1883.1; Philips, B. 1884.1, 2; Pousielgue, E.; Rathbun, R. 1898.1; Smith, H. M. 1893.4; Stearns, S. 1883.1, 1884.1, 1885.1, 1887.1, 4; Wood, M. L. 1883.1; Bryce, J. J. Add. 1897.1; Henshall, J. A. Add. 1898.1; Smith, H. M., Evermann, Cobb, & Kendall. Add. 1897.1. — *Indian R.* Bean, B. A., Evermann, & Wilcox, 1897.1; Brice, J. J. 1898.1; Wilcox, W. A. 1898.1. — *St. John's R.* Goode, G. B. 1874.4.

National Fishery Congress, held at Tampa, Jan. 19–24, 1898. Proceedings in Bull. U. S. Fish Comm. 1897, vol. XXVII, 145–371.

Georgia: Alexander, A. B. 1905.5; Earll, R. E. 1887.3; Janes, T. P. 1878.1; McDonald, M. 1887.7; Smith, H. M. 1893.4.

Illinois: Cohen, N. H. 1902.1; Nelson, E. W. 1878.1. — *Statistics.* Smith, H. M. 1898.6.

Kansas: *Laws.* Dyche, L. L. 1913.1. *Statistics.* Smith, H. M. 1898.6.

Louisiana: Alexander, A. B. 1905.3; Collins, J. W., & Smith, H. M. 1893.1; Hart, W. O. 1913.1; Smith, H. M. 1898.6.

Maine: Alexander, A. B. 1905.4 (*Statistics*); Atkins, C. G. 1870.2; Baird, S. F. 1874.15; Boardman, S. L. 1863.1; ★Earll, R. E. 1881.1, 1887.1; Foster, N. W., & Atkins, C. G. 1868.1; Hall, A. 1898.1; Wasson, S. Add. 1878.1; Bishop, W. H. Add. 1885.1; Sullivan, J. Add. 1795.1. — *Penobscot River fisheries.* ★Atkins, C. G. 1887.2; Evermann, B. W. 1905.9; Hamlin, A. C. 1874.1; Lincoln, T. 1874.1; Smith, H. M. 1898.5.

Maryland: Earll, R. E. 1887.5; Ferguson, J., & Hughlett. 1880.1; George, A. F. 1900.1; Hamlen, W. 1885.1, 1886.1; Knight, W. 1883.1; Shrigley, N. 1844.1; — *Chesapeake Bay.* McDonald, M. 1887.3; Wood, W. M. 1884.4. — *Potomac R.* Baird, S. F. 1876.18; Harris, G. 1884.1, 2, 1885.1, 1887.1; Milner, J. W. 1876.4; Smith, H. M. 1890.1; Elliot, J. Add. 1830.1.

Massachusetts: *River fisheries.* Fobes, P. 1794.1; True, F. W., & Wilcox,

W. A. 1887.1; Wood, Wm. 1873.1; Garman, S. Add. 1891.1.

Marine fisheries chiefly. Alexander, A. B. 1905.4; Anderssen, J. 1880.1; Baird, S. F. 1873.44; Bean, T. H. 1892.7; ★Clark, A. H. 1887.2; Earll, R. E. 1880.1; Freeman, F. 1860.1; Goode, G. B. 1877.4; McDonald, J. L. 1871.1; ★McFarland, R. 1911.1; Nye, W. 1889.1; Paine, Young, Bangs, & Stearns, 1792.1; Palmer, G. H. 1873.1; Roads, S. 1880.1; Whitman, L. 1794.1; Young, A. 1846.1; Anon. 117, 517; Atwood, N. E. Add. 1871.1, 2, 1873.1; Lyman, Th. Add. 1872.1; Young, I. C. Add. 1895.1. — *Pre-Linn. refs.* Higginson, F. 1630.1; Wood, W. 1634.1.

Gloucester fisheries. Babson, J. 1860.1; Baird, S. F. 1873.16; Clark, A. H. 1884.1; Martin, S. J. 1882.2–1885.1; Wilcox, W. A. 1889.1.

The codfish in Massachusetts history. Rantoul, R. S. 1868.1. — *History of emblem of codfish in House of Representatives.* Anon. 295.

Commissioners of Fisheries; annual reports, 1867–1887. Anon. 355.

For testimony regarding condition of the shore fisheries in 1871, herein listed under individual names, see Rept. U. S. Fish Comm. 1871–72, (I), 7–72, 182–195.

Michigan: Jerome, G. H. 1875.1, 1876.1; Paxton, E. B. 1879.1, 2; Philips, B. 1875.5.

Mississippi: Alexander, A. B. 1905.3; Collins, J. W., & Smith, H. M. 1893.1; Hussakof, L. 1910.5, 1911.3; Smith, H. M. 1898.6.

New Hampshire: Alexander, A. B. 1905.4; Bean, B. A. 1891.14, 1893.1; True, F. W., & Wilcox, W. A. 1887.1; — *General account.* Wilcox, W. A. 1887.1.

New Jersey: ★Earll, R. E. 1887.6; Smith, H. M. 1894.1. — *Delaware R.* Cobb, J. N. 1900.2; Howell, S. 1837.1; Jann, P. F. 1887.1, 2; McDonald, M. 1884.3.

New York: Akerly, S. 1817.1; Bean, T. H. 1891.15; Blackford, E. G. 1879.1, 2; C., H. E. 1871.1; Cheney, A. N. 1897.2, 1901.1; Cobb, J. N. 1905.1; Kalm, P. 1761.1; Lamphear, G. 1881.1; ★Mather, F. 1887.1; Pond, J. W. 1897.1; Roosevelt, R. B. 1878.5; Smith, H. M. 1898.6 (*Statistics*); Anon. 139. — *Hudson R.* Blackford, E. G. 1887.1; McDonald, M. 1887.5; Mather, F. 1885.4.

North Carolina: Alexander, A. B. 1905.5 (*Statistics*); Cobb, J. N. 1906.3; Earll, R. E. 1887.7; McDonald, M. 1887.6; Smith, H. M. 1893.4, 1907.1; Worth, S. G. 1881.1, 1883.2, 1885.1, 1889.1, Add. 1884.1; Yarrow, H. C. 1874.1, 2; Milner, J. W. Add. 1882.1.

Ohio: Bean, T. H. 1911.17; Gunckel, J. E. 1893.1; Klippart, J. H. 1876.2; Smith, H. M. 1898.6.

Oregon: *Chiefly salmon.* A. 1874.2; Borne, M. 1878.9; Bretherton, B. J.

1900.1; Carll, W. E. 1904.1; Cranston, C. K. 1913.1; Goode, G. B. 1881.8; Grover, G. 1874.1; Jordan, D. S., & Gilbert, C. H. 1888.2; Tanner, Z. L. 1890.1, 1893.1; Wilcox, W. A. 1895.1, 1902.1, 1906.1.

Pennsylvania: Bean, T. H. 1891.16; Buller, N. R. Add. 1905.1; Butler, N. R. (*correctly Buller*) 1914.1; Earll, R. E. 1887.8. — *Laws*. James, B. W. 1896.1–1902.1. — *Schuylkill fishing company*, 1732–1888. Milnor (Jr.) W. 1830.1–1889.1. — *Susquehanna R. (Shad)*. Willis, H. 1882.1; Wright, H. 1884.1, Add. 1882.1. — *Disappearance of black bass*. Campbell, E. W. Add. 1905.1.

Rhode Island: Alexander, A. B. 1905.4; Church, D. T. 1894.1; ★Clark, A. H. 1887.3; Goode, G. B. 1877.4. — *Statistics*. Anon. 137, 517.

For testimony regarding condition of the shore fisheries in 1871, herein listed under individual names, see Rept. U. S. Fish Comm. 1871–72, (I), 7–72, 182–195.

South Carolina: Alexander, A. B. 1905.5; Earll, R. E. 1887.3; Ferguson, T. B. 1884.1; Huske, C. J. 1884.3; McDonald, M. 1887.7; Smith, H. M. 1893.4; Wood, W. M. 1884.1, 2.

Tennessee: H., J. D. 1879.1, 2, 1880.1. — *Statistics*. Smith, H. M. 1898.6.

Texas: Alexander, A. B. 1905.3; Collins, J. W., & Smith, H. M. 1893.1. — *Coast fisheries*. Stevenson, C. H. 1893.1.

Utah: Rockwood, A. P. 1874.2, 1876.1; Siler, A. L. 1884.1. — *Statistics*. Smith, H. M. 1898.6.

Vermont: Cobb, J. N. 1905.1. — *General account*. Williams, S. 1794.1. — *Statistics*. Smith, H. M. 1898.6.

Virginia: Downman, R. H. 1883.1 (*Rappahannock R.*); H. 1876.1; McDonald, M. 1887.12; Mather, F. 1875.1; Shrigley, N. 1844.1. — *Coast fisheries*. Wilkins, J. T. 1894.1.

Washington: Goode, G. B. 1881.8; Jordan, D. S., & Gilbert, C. H. 1888.2; Rathbun, R. Add. 1900.1 (*General review*); Stone, L. 1883.6 (*Little Spokane R.*); Swan, J. G. 1885.1, 1894.1 (*Puget Sound*); Tanner, Z. L. 1890.1, 1893.1; Wilcox, W. A. 1898.2, 1902.1, 1906.1. — *For Columbia R. salmon fisheries, see Fisheries, Salmon.*

Wisconsin: Hoy, P. R. 1876.2; Nevin, J. 1889.1.

WEST INDIES

Misc. Hansen, C. 1896.1. — *Bahamas*. Adderley, A. J. 1883.1; Nye, W. 1887.1. — *Barbados Is.* Duerden, J. E. 1901.1. — *Bermuda Is.* Goode, G. B. 1876.1. — *Cuba*. Garcia Canizares, F. 1911.1; Poey y Aloy F. 1883.1; Stearns, S. 1887.3. — *Curacao I.* Boeke, J. 1906.2, Add. 1907.1. — *Jamaica*. Duerden, J. E. 1898.1. — *Porto Rico; General account*. Wilcox, W. A. 1900.1, 1903.1.

SOUTH AMERICA

Argentina: Iches, L. 1911.1; ★Lahille, F. 1895.2–1910.1, 1906.3.

Brazil: Ribas, C. Add. 1913.1; Wappäus, J. E. 1871.1.

Chile: Albert, F. 1903.1, 1912.1, 4; Castillo, L. 1912.2, 3, 8, 9, 13; Kruuse, H. G. 1879.1, 1882.1; Meza, A. 1912.1; Ovalle, F. P. 1912.1, 2, 3, 4; Perez Canto, C. 1912.1; ★Pomar, L. 1900.1, 1901.1; Reed, E. C. 1901.1; Uribe, L. 1900.1, 1901.1; Wolnitzky, B. 1901.1.

The official government publication is the "Boletin de Bosques, Pesca, i Caza," published at Santiago.

Guiana, British: Appun, F. 1870.1; Rodway, J. 1913.1, Add. 1913.1; Sagot, P. A. 1874.1.

Guiana, Dutch: Kappler, A. Add. 1854.1, 1887.1.

Peru: Coker, R. E. 1908.1, 2, Add. 1908.1, 1913.1; Kruuse, H. G. 1879.1, 1882.1.

Uruguay: Sage, C. 1912.2.

Venezuela: Gairaud, C. 1899.1; Geay, F. 1896.1 (*Orinoco R.*); Paez, R. 1863.1.

ASIA

General. Brass, E. 1904.1; Gonzaga, C. A. Add. 1904.1.

Baluchistan: Anon. 671.

Cambodia: Cacheux, E. 1903.1; ★Pétilot, L. 1911.1.

Ceylon: Pearson, J. 1912.2. — *Freshwater*. Willey, A. 1908.2, 1910.1, Add. 1909.1.

China: Campbell, J. D. 1883.1; Courcy, — 1866.1; Girard, O. 1869.1; Weber, M. C. 1880.1; Weeger, E. 1879.1; ★Yen, W. 1910.1.

India: Baird, S. F. 1873.14; Comber, E. 1907.1; ★Day, F. (*Freshwater*) 1871.7, 1873.5; (*Marine*) 1873.6, 1883.4, 1885.4; McDonald, D. G. 1883.1 (*Bombay*); Martin, M. 1838.1; Mattson, H. 1885.1; Thurston, E. 1894.1, 1900.1; Wallinger, W. A. 1907.1; Anon. 232.

Bengal fisheries. Day, F. 1877.1; Duke, F. W. 1911.1; Gupta, K. G. 1911.1, 2, 3; Hornegg, C. 1880.1; Jenkins, J. T. 1911.1–4; Anon. 138.

Bengal fisheries steam trawler "Golden Crown," operations, scientific results, etc. Ahmad, A. 1911.1; Annandale, N. 1909.1, 1910.1; Annandale, N., & Jenkins, J. T. 1910.1; Chaudhuri, B. L. 1908.2; Jenkins, J. T. 1910.2–1912.1.

The official publication of the Madras Fisheries Bureau is the "Bulletin."

Japan: Albert, F. 1912.3; Baldwin, C. H. 1884.1; ★Gregory, G. E. 1877.1; Irrarázaval, A. 1912.1; Ito, K. 1887.1, 1888.1 (*Hokkaido I.*); Jouan, H. 1867.2; Kamada, T. 1909.1; Kishinouye, K. 1898.1, 3, 1902.2; Kitahara, T. 1910.1–1912.1; Matsubara, S. 1902.1–1903.1;

Fisheries — Cont'd.

★Nicholson, F. A. 1907.1; Okamura, K., & Marukawa, H. 1909.1; Okoshi, N. 1883.1; Owston, A. 1907.1; Smith, H. M. 1894.2, 1904.8, 1905.3, (*Trade with U. S.*) 1905.8, Add. 1905.3; Tagawa, I. 1904.1; Anon. 666 (*Catalogue*), 681; Schmidt, P. Add. 1903.1.

The official publication of the Fisheries Bureau of the Department of Agriculture and Commerce is the "Journal of the Imperial Fisheries Bureau," published at Tokyo.

Persia: Churchill, — 1877.1.

Russian Central Asia: Berg, L. S. 1902.1, 1905.3.

Siam: Turpin, — Add. 1771.1.

Siberia: Bush, R. J. 1871.1; Makarenko, A. A. 1902.1 (*Angara R.*); Melnikov, V. S. 1910.1; Ostrovskich, P. 1909.1 (*Yeniseisk*); Sokolnikov, N. P. 1911.1. — *Amur R.* Nordmann, A. 1861.1; Wetterich, A. 1880.1; Zur Mühlen, M. 1911.12. — *Lake Baikal.* Kuznetzov, I. D. 1909.1. — *Sakhalin I.* Schmidt, P. Y. 1902.1, 1905.1.

Syria: Robeson, J. S. 1885.1. — *Galilee.* Masterman, E. W. Add. 1908.1.

EUROPE**General treatises**

Fluctuations in the great fisheries of northern Europe. ★Hjort, J. 1914.1. — *The fisheries of the various countries [of Europe]. Statistics of North Sea fisheries.* ★Hoek, P., & Kyle, H. 1905.1; ★Kyle, H. M. 1905.3, 1906.1, 1908.1. — *General statistical treatises.* Anon. 115, 116, 142.

For an authoritative recent treatise, the reader should consult "The Sea Fisheries," by ★J. T. Jenkins, London, 1920. 299 p. 57 pls.

AUSTRIA-HUNGARY

For statistics the *Statistische Monatschrift* and the *Statistisches Jahrbuch* for Austria should be consulted.

General and miscellaneous. Borne, M. 1882.1; Clodi, E. 1911.1; Cori, C. J. 1904.1; Deutsch, G. 1880.1; Hartemann, R. 1880.1; Karny, G. 1880.1; Krafft, C. 1874.1–1875.1; Landgraf, J. 1897.1; ★Marchesetti, C. 1882.1, 1883.1; Peyrer, C. 1874.1, 1876.1; Pfundheller, J. 1880.1; Wittmack, M. C. 1875.1, 2; Deml, J. Add. 1911.1.

Adriatic sea fisheries. Adler, H. 1903.1; ★Faber, G. L. 1883.1; Schmarda, L. K. 1864.1; Weaver, J. R. 1885.1.

Depletion of fishery resources. Desco, B. 1902.1; Kässbohrer, M. 1880.1; Toulou, F. 1874.1; Windsteig, G. 1880.1, 2; Anon. 16.

Markets, Vienna. Krisch, A. 1900.2. — *Triest.* Plucàr, E. 1846.1.

River fisheries, chiefly of Danube. Gutmann, — 1861.1; Kässbohrer, M. 1880.1; Prohaska, — 1880.1, 2; ★Répásky, M. 1909.1; Rössler, E. 1909.1; Staudenmayer, G. 1893.1; Wengen, — 1871.3.

Austria: *Bohemia (Prov.).* Fritsch, A. J. 1873.1, 1888.1; Horak, W. 1877.1, 1878.1. — *Bosnia and Herzegovina.* Curčić, V. 1912.1; Anon. 672. — *Carinthia (Prov.).* Wutte, M. Add. 1912.1. — *Carniola (Prov.).* *Czirknizer-See.* Steinberg, F. A. Add. 1761.1; Valvasor, J. W. Pre-Linn. 1688.1. — *Dalmatia (Prov.).* Moles, G. Add. 1776.1. — *Galicia (Prov.).* Lindes, L. 1880.15; Sweizawski, E. 1880.1; *Skawina R.* Anon. 639. — *Istria (Crownland), Lussin I.* Wölfelin, L. G. 1901.1. — *Moravia (Prov.).* Zila, F. 1880.1. — *Styria (Prov.).* Aussee (Gebiet). Wallner, J. Add. 1911.1. — *Tyrol (Prov.).* *Trent.* Bononi, A. Add. 1913.1. — *Upper Austria.* Hoppichler, H. 1880.1.

Hungary: (*Kingdom*). Baumgartner, — 1879.1 (*Balaton Lake*); Brusina, S. 1892.1 (*Croatia*); Hermann, O. 1887.1; Hornegg, C. 1880.2; Jankó, J. 1900.1; Schmidt, L. 1887.1; Korach, A. Add. 1902.1 (*Tolna*); Sztripszky, H. Add. 1902.1, 2; Anon. 663.

AZORES ISLANDS

Graciosa I., General treatise, text in Spanish. Silva Ferro, R. 1875.1.

BALTIC SEA

Beerbohm-Feilenhof, — 1872.1; Etzel, A. 1859.1; Heidrich, — 1902.1; Hoek, P., & Trybom, F. 1907.1; Kirsch, A. 1903.1; Meyer, H. A. 1872.1–1878.1; Meyer, & others. 1882.1; Schiemenz, P. 1902.1; Schneider, G. 1898.3, 1900.7, 1905.2, 11, 1906.6; Trybom, F. 1910.1; Widegren, H. 1874.1, 1880.1.

See also under Fisheries, Germany.

BELGIUM

The official fishery statistics are published in the annual *Tableau General du Commerce avec les Pays étrangers*.

Bardin, A. 1866.1; Friedel, E. 1871.1; Gens, E. 1893.1 (*Lake Gileppe*); Gevers Deynoot, W. T. 1829.1; Gilson, G. 1908.1; Hymans, — 1866.1; Maes, L. 1898.1; Mann, A. T. 1780.1; Selys-Longchamps, M. E. 1866.1; Verhoeven, G. T. 1780.1 (*Gen. treat.*); Anon. 540.

For a general treatise, consult Charles de Zutteres, "Enquête sur la pêche maritime en Belgique." Bruxelles, 1909.

BLACK SEA

Borodin, N. A. 1901.1; Fomin, L. S. 1901.1; Jacentkovskij, A. V. 1909.1; Maksimov, N. E. 1913.1; Pozniakov, A. 1908.1; Satunin, K. A. 1908.1, 2; Schneider, G. 1900.7; Tichij, M. 1912.2; Zernov, S. A. 1902.1.

See also under surrounding countries.

BRITISH ISLES

General treatises: Bertram, J. G. 1865.1, 1866.1; ★Brabazon, W. 1848.1; Day, F. 1884.1; Fraser, R. 1818.1; ★Fulton, T. W. 1911.2; Gunn, W., & McLeod, M. G. 1889.1; ★Holdsworth,

E. W. 1874.1, 1877.1; ★Johnstone, J. 1905.2; Phelps, S. 1818.1; Rose, J. 1785.1; Smart, J. 1848.1; Wood, Walter, 1911.1.

See also "The Sea Fisheries" by ★J. T. Jenkins. London, 1920.

Depletion of fisheries: Causes, with remedial suggestions. Abbs, C. 1792.1; Crumplen, T. 1881.1; Header, J. N. 1871.1, 1873.1; Young, A. 1854.1; Dunn, M. Add. 1890.1.

Effects of the closure of certain areas in Scottish seas. McIntosh, W. C. 1899.2-4.

Historical items: Anderson, James, 1782.1, 1786.1; Young, L. J. 1865.1, 1872.1.

For "Parliamentary papers" referring to British Fisheries, 1511-1881, see titles (pp. 270-293) in Westwood & Satchell, 1883.1. See also "Catalogue of Parliamentary Papers, 1801-1900," also "1901-1910," published in London by P. S. King & Son.

Legislation: Regulations, reports and recommendations of committees, commissioners, etc.; statutes for conservation, etc. Allen, E. J. 1897.2; Buckland, F. T. & Walpole, S. 1879.1; Caird, Huxley, & Lefevre, 1873.1; Cornish, J. 1824.1; Coumes, — 1881.1; Fryer, C. E. & Masterman, A. T. 1905.1, 1906.1; Lloyd, J. 1868.1; Anon. 18, 255, 301, 469; Armistead, J. J. Add. 1890.1; Dunn, M. Add. 1891.1; Lawrence-Hamilton, J. Add. 1894.2.

Miscellanea: Adams, W. M. 1883.1; Allen, E. J. 1909.1; Coumes, — 1863.1; Duff, R. W. 1885.1; Edinburgh, Duke of, 1883.1; Lindeman, M. 1876.1, 1877.1; Monson, W. 1745.1; Walpole, S. 1883.1; Webb, W. F. 1870.1; Wilcocks, J. C. 1883.3; Calderwood, W. L. Add. 1894.1.

For papers concerning the Great International Fisheries Exhibition, London, 1883, see under Fisheries, Exhibitions.

England

Statistics of the fisheries of England and Wales will be found in the *Reports of the Inspectors of Sea Fisheries*, 1886-1902, and its continuations.

General and miscellaneous papers. ★Aflalo, F. G. 1891.1, 1898.1, 1901.1, 1904.3; Ashworth, T. 1868.1; Bellamy, J. C. 1843.1; Buckland, F. T. & Walpole, S. 1879.1; Jardine, W. 1862.1; Lee, R. M. 1909.1-1912.1; Longuety, L. 1878.2; Scott, A. 1914.1; ★Stanford, E. C. 1864.1; Wheeler, R. F. 1864.1.

For anchovy, herring, mackerel, and pilchard fisheries of England, see Fisheries, under these subjects.

Inland fisheries: Albin, E. 1794.1; Harding, C. W. 1882.1 (*Wash R.*); Napier, C. O. 1879.1; Southwell, T. 1884.2 (*Norfolk*); Weiss, F. E. 1909.1; Wheelodon, J. P. 1883.2. — *Thames R.* Binnell, R. 1785.1; Murie, J. 1903.1; Anon. 157. — *Lake district.* Buckland, F. & Walpole, S. Add. 1878.1.

Markets: A central market for London. Cayley, J. J., & Bridgeman, H. H. 1883.1. — *Billingsgate market of London; description, etc.* Cox, W. 1886.1; Walpole, S. 1881.1, Add. 1882.1; Anon. 675. — *Lowestoft market.* Southwell, T. 1901.1.

Various localities: *Berwickshire.* Huntley, R. H. 1876.1. — *Devonshire, Plymouth sea-fisheries.* Calderwood, W. L. 1892.4, 1893.1; Heape, W. 1887.1; Roach, W. 1889.1; Scott, W. R. 1864.1. — *Dorsetshire.* Beckford, F. J. 1897.1. — *English Channel and Channel Islands.* Hornall, J. 1897.1; Olsen, O. T. 1883.1 (*Atlas*); Stacy-Watson, C. 1883.1 (*Yarmouth*); Wilcocks, J. C. 1877.1; Woodley, G. Add. 1822.1 (*Scilly Is.*). — *Gloucester* Pew, J. J. 1901.1; Procter, G. H. 1876.1, 1882.1. — *Lancashire (Sea-fisheries).* Jackson, C. L. 1899.1; Jenkins, J. T. 1905.1. — *Lincoln, Grimsby.* Finn, W. 1879.1; Holt, E. W. 1893.1. — *Norfolk.* Southwell, T. 1884.1, 3. — *Northumberland sea-fisheries.* Meek, A. 1897.1, 1905.2, 1907.1, 1909.3. — *Suffolk.* Patterson, A. H. 1909.3. — *York, Scarborough.* Holt, E. W. 1893.2.

Ireland

The annual publications of the Fisheries Branch of the Dept. of Agriculture and Technical Instruction are the "Scientific Investigations," and the "General Reports, 1902 to 1907," issued at Dublin.

Marine or sea-fisheries, chiefly. Aicard, J. 1892.1; Andrews, W. 1865.3, 1875.1, Add. 1857.1, 1861.1; Blake, J. A. 1863.1, 1868.1; Bloomfield, J. C. 1883.1; Brabazon, W. 1848.1; Brady, T. F. 1873.1; Butt, I. 1874.1; ★Fraser, R. 1818.1; Green, W. S. 1894.1; Hoare, J. 1870.1; Patterson, R. L. 1880.2 (*Belfast Lough*); Warren, R. (*Moy estuary*) 1898.1, 1905.1; Wilcocks, J. C. 1883.3; Anon. 483; (*Gen. treat.*) Hore, H. F. Add. 1850.1.

Pre-Linn. references. Smith, C. 1744.1-1756.1.

Irish Sea investigations. Herdman, W. A. 1903.3; Herdman, & Dawson, R. A. 1902.1; Johnstone, J. 1912.3; Smith, H. M. 1902.3.

Survey of fishing grounds, west coast of Ireland. Haddon, A. C. 1892.1; Holt, E. W. 1892.4-7; Prince, E. E. 1890.3; Poole, T. H. 1892.1.

For salmon fisheries of Ireland, see Fisheries, Salmon.

Scotland

The researches of the Fishery Board for Scotland appear in its *Annual Report*, and in *Scientific Investigations*.

General and miscellaneous papers. Bell, H. 1774.1, 1792.1; Bompas, G. 1885.1; Buchan, P. 1819.1; Calderwood, W. L. 1899.1; Carr, T. F. 1884.1; Cowe, R. 1834.1; Fletcher, J. 1905.1, 1906.1; ★Fulton, T. W. 1881.1, 1890.3, 1891.1, 3, 1892.1, 4, 1893.1, 1894.1, 1895.1, 1902.2, 1910.2; Fulton, & Fullarton, J. H. 1889.1; Logan, G. 1863.1, 2; ★Mc-

Fisheries — Cont'd.

Intosh, W. C. 1892.3, 1899.3, 4, 1912.1, .2; Matthews, J. D. 1884.1; Mohr, N. 1782.1; Paulin, G. L. 1876.1; Pitcairn, G. 1787.1; Ross, J. 1883.1; Stirling, J. 1883.2; ★Thompson, D. W. 1905.1, .2, .3, 1908.1, .2, 1914.1, .2, 1915.1; White, P. 1791.1; Wilcocks, J. C. 1883.4; Anderson, J. Add. 1885.1; Knox, J. Add. 1785.1. — *Chief fishing ground on east coast of Scotland, maps, etc.* Fulton, T. W. 1891.3. — *Pre-Linn. reference.* Martin, M. 1716.1.

For herring and salmon fisheries of Scotland, see Fisheries, under these subjects.

Orkney Islands, fisheries. Barry, G. 1805.1; Edmonston, A. Add. 1820.1.

Shetland Islands, fisheries. Annaniassen, A. 1885.1; Duthie, R. 1891.1; Edmonston, A. Add. 1809.1, 1820.1.

Fisheries statutes, 1424–1705; for list, consult the bibliography of Westwood & Satchell, 1883.1.

Fishery Board for Scotland: *General index to scientific reports, 1883–1904.* Fulton, T. W. 1905.1.

Results of scientific investigations. ★Fulton, T. W. 1888.1–1913.2; Robertson, W. C. 1900.1; Williamson, H. C. 1893.1–1914.1.

"Garland," *Fishery Board Steamer; results of trawling experiments, ova and larvæ collected, etc.* Calderwood, W. L. 1886.1; Fulton, T. W. 1890.5, 1891.6, 1892.4, 1893.3, 1894.5, 1895.4, 1896.3, .4, .5, 1897.2, 1898.4, 1899.2, 1900.3; Wallace, W. 1896.1; Williamson, H. C. 1895.1; Williamson, H. C., & Tosh, J. R. 1894.1; Ewart, J. C., & Maitland, J. R. G. Add. 1887.1, 1888.1; Ewart, Maitland, & Fulton. Add. 1889.1.

Dunbar Marine Hatchery. Reports of operations. Dannevig, H. C. 1896.1, Add. 1898.1, 1899.1; Dannevig, H. C., & Fulton, T. 1895.1; Fulton, T. W. 1894.2, .4; McIntosh, W. C. Add. 1894.2.

Hatching station maintained at Bay of Nigg, Aberdeen. Operations, 1900–1909. Dannevig, H. C. 1901.1, 1902.1; Fulton, T. W. 1903.4, 1904.6, 1905.4, 1906.4, 1907.2, 1909.2, 1910.1, 1911.1.

Tarbert Laboratory, marine fishes collected in 1885. Brook, G., & Scott, T. 1885.1.

For St. Andrews Laboratory, replaced by Gatty Marine Lab., see under Stations & Laboratories, above.

Wales

General treatise. Stanford, E. C. 1864.1. — *Marine fisheries, chiefly.* Aflalo, F. G. 1904.3; Allen, E. J. 1897.2. — *Salmon, condition in 1861.* Jardine, W. 1862.1. — *St. Georges Channel.* Olsen, O. T. 1883.1.

BULGARIA

Les poissons au point de vue industriel et leur pêche dans la mer Noire. Maksimov, N. E. 1913.1.

DENMARK

The *Dansk Fiskeriforening* (Danish Fishery Society) publishes a weekly journal, *Dansk-Fiskeritidende*, Helsingfors. This society publishes also a yearly report, *Aarsberetning for Driftsaaret*. The *Dansk Fiskehandler og Havfiskeriforening* (Fish Traders' Assoc.) publishes a journal, the *Fiskeribladet*.

Work of the Danish Deep-Sea Commission. Schmidt, E. J. 1904.1. *For work of the State Biological Station under the Department of Agriculture, at Nyborg, Fyen I., see under Stations & Laboratories, above.*

Various papers and treatises, chiefly of sea fisheries. Andersen, B. 1866.1–1879.1; Bendixen, B. E. 1868.1; Brammer, C. 1872.1–1874.1; Collin, J. 1873.1, 1878.1; ★Drechsel, C. F. 1890.1; Ekström, C. 1844.2, 1845.1, 1850.2; ★Feddersen, A. F. 1866.1–1900.2, 1873.1; Finn, W. 1880.4; ★Hjort, J., & Petersen, C. G. 1905.1; Høst, H. E., & Collin. 1874.1; Jensen, O. S. 1880.1, 1883.1; Jørgensen, — 1896.1; Johansen, A. C. 1905.1, 1906.1; ★Johansen, A. C., & Neergaard-Møller, E. 1912.1–1913.1; Kroyer, H. N. 1837.1; Ljungman, A. V. 1875.1; Lönnberg, A. J. 1894.2; Lofting, J. C. 1900.1; Lund, C. F. 1876.1; Lütken, C. F. 1873.3; Osterbol, A. 1873.1–1879.1; Otterendorp, C. G. 1880.1, 1889.1; ★Petersen, C. G. 1884.1–1912.1; Petersen, C., Garstang, W., & Kyle, H. M. 1907.1; Petersen, R. 1872.1; Quigstad, J. 1905.1; Schmidt, V. 1878.1; Schiødte, J. M. 1868.1, 1877.1; Skrydstrup, V. 1875.1 (*Salmon*); Smidth, A. J. 1869.1; Widegren, H. 1870.3; Willumsen, P. J. 1882.1, 1892.2; Winther, G. P. 1874.1–1878.1; Wulff, D. H. 1878.1; Jensen, F. Add. 1905.1; Knudsen, P. C. Add. 1911.1, .2, .3; Lubecker, J. L. Add. 1772.1; Mortensen, F. V. Add. 1912.1.

For Danish plaice fisheries, see above under Fisheries by subjects.

FAROE ISLANDS

Høst, H. E. 1873.1, 1875.1; Landts, — 1800.1; Lorenzen, A. 1898.1; Mohr, N. 1782.1; Mortensen, F. V. Add. 1910.1.

FRANCE

Statistics are published annually in the *Statistique des Pêches Maritimes*. Details of French fisheries at Iceland and Newfoundland appear in *Revue Maritime*, Paris.

For sardine fisheries, chiefly of Brittany, see Sardine Fisheries, above.

General treatises

Laurent, Ph. 1833.1; Le Grand d'Aussy P. 1864.1; Mallet, — 1866.1; Rimbaud, J. B. 1865.1–1870.1; ★Roule, L. 1914.8; Wallem, F. M. 1880.1; ★Ihø-Pale Add. 1905.1. — *French Colonial fisheries.* ★Darboux, G., Stephen, P., & others. Add. 1907.1.

Depletion of Fisheries

Causes of depopulation of French waters and means of restoration. Audigé, J. 1904.2; Berthelot, S. 1867.1; Blavier, A. 1882.1; Brocchi, P. 1889.2; Chapellier, J. C. 1865.1; Charvet, P. A. 1869.1; Corinaldi, E. 1878.1; Galbert, A. 1905.1; Gifford, G. 1883.1; La Blanchère, P. R. 1870.2, 1872.3; Machado de Carvalho, G. 1897.1; Raspail, X. 1900.1, 1903.1; Raveret-Wattel, C. 1873.2, 1883.2; Rouyer, — 1900.1; Stricker, W. 1875.1; Bénard, C. Add. 1902.1.

Code nouvelle de la pêche fluviale. Martin, E. 1885.1. — *Legislation affecting coastal fisheries.* Pizzetta, J. 1880.1. — *Laws, decrees, etc., 1789–1810.* Rondonneau, — 1810.1.

Pre-Linn. references to early French laws. Duval, 1699.1; Rousseau, C. 1633.1; Sainctyon 1610.1.

Definite localities

Ain (Dept.). Bossi, — 1808.1; Vaney, C. & Conte, A. 1908.1. — *Bouches-du-Rhône (Dept.).* Brocchi, P. 1881.1. — *Belfort.* Roesch, C. 1901.1. — *Boulogne-sur-Mer.* Deseille, E. 1873.1, 1876.1, Add. 1883.1; Martel, E. Add. 1898.1. — *Brittany (chiefly sardine).* Garel, E. Add. 1911.1; Le Danois, E. 1909.1; Pouchet, G. 1886.1–1891.3; Schlegel, C. 1910.1. — *Creuse (Dept.).* Boyer-Tonfrède, J. F. 1848.1. — *Étang de Thau.* Gourret, P. 1886.1, 1896.1, 2, 3, Add. 1896.1. — *Gironde (Dept.).* Daleau, F. 1898.1; David, — 1896.1; Allary, J. Add. 1913.1. — *Golfe de la Napoule.* Jaubert, Add. 1905.1. — *La Vendée (Dept.)* Cocaud, M. 1896.1. — *Loire R.* Bureau, L. 1891.1; Ivolas, J. Add. 1893.1; Paulze d'Ivoy, — 1901.2. — *Marseille.* Gourret, P. 1894.1–13, 1897.2, Add. 1893.1; Marion, A. F. 1894.4, 5, 6. — *Midi.* Gourret, P. Add. 1897.1. — *Nice.* Anon. 293. — *Port-Vendres.* Fage, L. 1907.1. — *Rhône R.* Gobin, A. 1869.1. — *Seine Inf. (Dept.).* Légal, J. 1869.1; Loring, M. G. 1881.1. — *Toulouse.* Roule, L. 1903.2. — *Corsica.* Fol, H. Add. 1894.1.

Miscellaneous papers

Acloque, A. 1903.1; Allent, B. [n. d.]; Arcère, L. E. 1763.1; Audiganne, A. 1868.1; Baird, S. F. 1872.7, 15, 1874.9; Bénardeau, F. 1905.1; Blanchard, C. E. 1866.1; Brandicourt, V. 1912.1; Cacheux, E. 1903.1; Cligny, A. 1912.11; Coste, J. J. 1866.2; Finn, W. 1880.3; Forcade la Roquette, — 1860.1; Giard, A., & Roché, G. 1899.1; Gillet de G., A. 1845.1; Hautefeuille, L. B. 1868.1; Hennequin, A. 1867.1; Jouffroy, J. 1865.1; Künstler, J. 1905.1; Lemoussu, 1860.1; Locard, A. 1891.1; Longuét, — L. 1860.1, 1868.1–1879.1; Mallet, — 1866.2; Peixotto, B. F. 1884.1; Poulet, J. B. 1879.1; Roché, G. 1893.1, 1894.1; Roule, L. 1900.2, 1905.3; Saint-Paul, G. D. 1905.1; Soubeiran, J. L. 1870.2; Stork, H. 1880.1; Walker, G. 1885.1; Anon. 407, 461, 528.

GERMANY

Publications of the central fishery society (*Deutscher Seefischerei-Verein*) are the *Mitteilungen* and the *Abhandlungen*. The journal of this society is the *Allgemeine Fischerei-Zeitung*.

General treatises

Biermann, A. 1865.1; ★Borgmann, H. 1892.1; Dittmer, R. 1902.1; Hartig, G. L. 1806.1; Hensen, V. A. 1874.1; Huebner, A. 1905.1; Reider, J. E. 1825.1; ★Skowronnek, F. 1904.1; ★Stahmer, M. 1913.1; Walther, F. L. 1820.1; Jokisch, K. Add. 1802.1. — *Deutscher Seefischerei-Almanach.* Dittmer, R. Add. 1909.1.

Bibliography. Enslin, T., & Engelmann, W. (1750–1842) 1843.1; Schneider, F. W. 1856.1.

Inland fisheries

Fisheries of rivers, lakes, canals, etc. Lampert, K. 1910.1; Oppenfold, — 1870.1; Petri, — 1873.1; Struck, H., Mahnkopf, E., & Kegel, W. 1907.1; Tesdorpf, A. 1888.1; Thum, E. 1913.1; Weigelt, C. 1900.1, 1902.1. — *Elbe R.* Breckwoldt, J. J. 1879.1, 1880.1; Ehrenbaum, E. 1910.3; Vogel, W. 1893.1; Voigt, F. 1870.1, 1878.2. — *Ems R.* Ehrenbaum, E. 1892.3. — *Lippe R.* Herwig, — 1879.1. — *Main R.* Boettger, O. 1871.1. — *Rhine R.* Melsheimer, M. 1878.1; Noll, F. C. 1874.1. — *Weser R.* Gether, A. 1863.1; Häpke, L. 1876.1–1913.1; Voigt, F. 1879.1; Steilen, D. Add. 1912.1.

Definite localities

Alsace-Lorraine: *Lothringer Fischereiverein. Meeting in Metz.* Doell, — Add. 1913.1. — *Fisher guilds in Illhäusern, Alsace.* Ungerer, — Add. 1912.1.

Baden: "Zur Geschichte der badischen Fischerzünfte." Ström, H. Add. 1788.1.

Bavaria: Deutsch, — 1879.1; Peetz, H. 1862.1; Staudinger, J. 1880.1, 1896.1; Surbeck, G. 1902.1, 1904.4, 5, 1905.5–1908.1; Deml, J. Add. 1913.1. — *Review of Deml, J. Schotte, W. Add. 1913.1. — Passau monastery, 1709–63.* Anon. 759.

Hesse: Landau, G. 1865.1, Add. 1865.1; Metzger, A. 1879.1; Nau, B. S. 1788.2; List, T. Add. 1912.1.

Prussia: *General treatises.* Marcard, E. 1870.1; Metzger, A. 1880.1, 1903.1. — *Other papers.* Besselich, N. 1875.1, 1876.1; Bloch, M. E. 1780.1; Boltze, F. 1874.1; S., W. 1867.1; Schallor, A. 1911.1; Ilström, J. Pre-Linn. 1721.1.

Brandenburg (Prov.). Eckstein, K. 1908.1 (*Gen. treat.*), Add. 1911.2; Mende, T. 1873.1; Zur Mühlen, M. 1908.2; Bestehorn, F. Add. 1913.1, 2; Havenstein, Add. 1903.1; Hegert, — Add. 1882.1; Reuter, Add. 1900.1. — "Regesten aus den Fischereiuurkunden der Mark Brandenburg 1150–1710." Buchwald, — Add. 1903.1.

East Prussia (Prov.). Beerbohm-Feilenhof, — 1872.1; Benecke, B. 1880.1,

Fisheries — Cont'd.

.2, .4, .5, 1881.1; Cohn, L. 1902.1; Nadmorski, — 1882.1; Rupp, H. 1862.1; Heyking, Add. 1914.1; Lübbert, E. Add. 1913.1.

Hannover (Prov.); Chiefly Emden herring fisheries. Dantziger, C. 1878.1, 1879.2; Groenewold, B. E. 1880.1; Rensen, P. 1872.1; Zimmermann, G. F. 1880.1.

Hesse-Nassau (Prov.), Kassel. Herrlein, — 1879.1.

Pomerania (Prov.) and Rügen I. Blankenburg, — 1879.1; Ehrenbaum, E. 1892.2; Einfeld, H. 1880.1; Friedrich, E. 1871.1, .2; Halbfass, W. 1901.1; Münter, J. A. 1863.1; Sassenhagen, K. 1878.1; Seligo, A. 1893.1, 1896.2; Anon. 11; Beintker, E. Add. 1912.1; Schiemenz, P. Add. 1898.1; Sell, J. J. Add. 1797.1, 1831.1.

Posen (Prov.). Grotrian, — 1907.1, Add. 1905.1; Karwowski, S. Add. 1912.1.

Schleswig-Holstein (Prov.). Dallmer, E. 1877.1 (*Gen. treat.*); Friedel, E. 1875.1; Hansen, C. P. 1871.1; Hubbe, — 1875.1; Lönnberg, A. J. 1892.3; Petersen, R. 1871.1; Stemann, — 1894.1; Anon. 682; Friis, N. C. Add. 1777.1, 1778.1.

— *Kaiser Wilhelm-Canal.* Andresen, P. 1899.1, 1900.1; Barfod, H. 1902.5, 1904.1; Hinkelmann, A. 1897.1–1906.1.

West Prussia. Benecke, B. 1880.1, .2, .4, .5, 1881.1, 1887.1; Busenitz, — 1904.1; Nadmorski, — 1882.1; ★Seligo, A. 1902.1.

Saxony: (*Kingdom*). Leonhardt, E. E. 1903.4; Steglich, B. 1895.1.

Württemberg: Doering, C. A. 1880.1; Klunzinger, C. B. 1881.1; Rueff, A. 1873.1, 1880.1; Sieglin, H. 1896.1; Wild, G. 1903.1.

Miscellaneous and general

Alvenstod, S. M. 1837.1; Andrée, K. 1867.1; Apstein, C. 1894.1–1910.1; Bieler, G. A. 1880.1; Borne, M. 1882.1, 1883.4, 1884.1; Finn, W. 1880.4; Fischer, E. G. 1879.1; Fischer, F. C. 1785.1; Fluegel, C. G. 1842.1 (*cod*); Geering, T. 1886.1; Glaser, F. 1878.1; Goettig, L. 1875.1; Guibaud, — 1872.1; Hamm, W. 1867.1; Henking, H. 1901.1, 1906.1, 1907.1, 1908.2, 1911.1; Hensen, V. A. 1911.1; Hinkelmann, A. 1908.1; Kohl, J. G. 1864.1; Kolb, M. 1868.1; L., (Dr.) 1879.1; Lammers, A. 1871.1; Leonhardt, E. E. 1903.8, 1904.8, 1905.9; Lindeman, M. 1869.1; Lübbert, H. O. 1906.1; Majunke, — 1875.1; Möbius, K. A. 1882.2, Add. 1880.1; Müller, A. 1858.1; Pochhammer, — 1866.1; Poher, E. 1911.1; Quantz, H. 1903.1; Schneider, G. 1909.2; Stahl, J. F. 1772.1; Sturz, J. J. 1862.1; Trotz, T. F. 1771.1; Wächter, — 1839.1; Wengen, — (*Historical*) 1871.2, .8, 1873.1, 1875.1; Wittmack, M. C. 1875.1; Zenk, F. 1883.1 (*Prices*); Anon. 595; Behr, S. Add. 1878.1; Eckstein, K. Add. 1912.1, 1913.1; Fischer, E. Add. 1904.1; Floericke, K. Add.

1914.1; Friedel, E. Add. 1881.1; Goldschmidt, H. Add. 1911.1; Lund, C. Add. 1913.1; Schweser, C. H. Add. 1774.1; Tscheiner, D. J. Add. 1821.1; Werlosching, J. B. Add. 1760.1.

Pre-Linn. references to German fisheries. Glovez, A. 1719.1; Khraisser, S. 1651.1; Lund, C. 1757.1.

GREECE

La pêche en Grèce. 87 p. Apostolidès, N. C. 1883.1.

A recent treatise is "Pisciculture Marine et les Poissons de la Lagune de Misso-longhi" by P. Panagiotopoulos. Athens, 1916.

ICELAND

General accounts. Johansen, A. C. 1903.1; Mohr, N. 1786.1; Sæmundsson, B. 1909.1; Sigurdsson, J. 1859.1.

Cod fisheries. Le Timbre, A. M. 1872.1; Trolle, C. 1885.1; Aragon, G. Add. 1875.1; Biarno, E. Add. 1782.1; Pontoppidan, E. Add. 1787.3.

Halibut fisheries. Collins, J. W. 1886.1; Thorsteinson, A. 1885.1.

Miscellanea. Aicard, J. 1892.1; Andreassen, K. 1897.1; Braun, M. G. 1902.1 (*German fisheries*); Coumes, — 1863.1; Crowe, — 1869.1; Ehrenbaum, E. 1904.2; Finn, W. 1880.1, 1882.1; Garde, A. 1886.1; Gröndal, B. 1891.1; Hearn, W. R. 1899.1 (*French fisheries*); Holt, E. W. 1893.2; Paul, — 1902.1; Phelps, S. 1818.1; Schmidt, E. J. 1904.1; Thorarinnsson, B. S. 1889.1; Thorsteinson, A. 1885.1, 1886.1; Trolle, C. 1883.1; Erichsen, J. Add. 1783.1; J., C. Add. 1885.1; Jacobson, H. Add. 1885.1; Olaffen, O. Add. 1771.1; Stephanssyn, O. Add. 1787.1; Horrebow, N. Pre-Linn. 1752.1–1758.1.

ITALY

For statistics the reader should consult *Annuario statistico Italiano sulle Condizioni della marine mercantile Italiana al 31 Dic. 19. ., Relazione del Direttore Generale . . . Roma.*

General treatises

Text generally in Italian. ★Barbieri, C. 1907.3; ★Manetti, L. 1905.1; Negre, L. 1874.1; Ninni, E. 1907.1 (*Fresh-water*); Somigli, C. 1912.1; ★Targioni-Tozzetti, A. 1871.1, 1872.1, .2, 1880.1.

Bibliography. Cavanna, G. 1880.1; Lastri, M. 1787.1.

Vocabolario generale di pesca. Tommasini, C. 1906.1.

Lake and River Fisheries

Canestrini, G. 1873.1; Gemelli, G. 1905.1; Pavesi, P. 1881.2; Pavesi & Sulzer, J. 1881.1; Zacharias, E. O. 1905.2; Grassi, L. Add. 1903.1.

Lake Como. Besana, G. 1901.1; Cetti, G. 1862.1; Comolli, G. 1848.1; Mazzarelli, G. F. 1907.1; Regazzoni, I. 1864.1; Vinciguerra, D., Besana, Burguières & others. 1902.1; Bettoni, E. Add. 1894.1.

Lake Garda (or Benaco). Garbini, A. 1897.1; Wagner, P. 1897.1.

Lake Maggiore. Andrea, M. 1901.1; Bettoni, E. Add. 1894.1.

Marine Fisheries

Including waters around Sardinia and Sicily. See also Mediterranean Sea, following.

Avolio, F. P. 1816.1; Baird, S. F. 1872.11; Bellemo, E. 1906.1; Bonivento, A. 1902.1, 1907.1; Brocchi, P. 1883.1; ★Costa, A. (*Gulf of Naples*) 1871.3, 1873.1; Ferretti, U. 1911.1; Giacobini, E. 1906.1; Grassi, G. B. 1913.2; Issel, A. & Fauche, — 1871.1; Magnani-Ricotti, G. 1899.1–1900.1; Mazzarelli, G. F. 1906.2; Mazzullo, L. 1906.1; Mercadante, L., Jan-naci, F. & Adorno, M. 1906.1; Moretti, S. 1887.1; Mundula, A. 1909.1; Muth, J. P. 1869.1; Nardo, G. D. 1864.1, 1871.1, 1871.3; Ninni, A. P. 1863.1; Nourse, T. 1899.1; Parona, C. 1898.1; Plehn, M. 1908.1; Police, G. 1910.1, 1912.2; Raggi, G. A. 1894.1; Raggi, L. 1904.1; Regazzoni, I. 1864.1; Rossati, G. 1908.1; Russo, A. 1913.1, 2; Sella, M. 1912.1; Senoner, A. 1880.1; Supino, F. 1912.3; Vinciguerra, D. 1896.1; Anon. 123, 441; Galliani, A. Add. 1903.1; Tomiolo, A. Add. 1904.1.

For fisheries carried on at the vast marine fish-farms of the Lagoon of Comacchio, see under Pisciculture, Italy.

Regulations: Legislation, etc. Canestrini, A. 1913.1; Canestrini, G. 1898.1; Pavesi, P. 1894.2; Rabbeno, A. Add. 1883.1. — Control of waters common to Italy and Switzerland. Pavesi, P. 1880.2.

Organization, Central Consultative Commission for Fisheries. Lankester, E. R. Add. 1886.1.

MEDITERRANEAN SEA

Armstrong, G. 1781.1; ★Berthelot, S. 1868.1; Coste, J. J. 1866.2; Gareis, A. 1875.1; Gourret, P. 1894.11; Gulia, G. 1905.1; Turrel, L. 1872.2, 1875.1, 1877.1; Worthington, J. 1885.1, 2.

Adriatic Sea: Aequaviva, A. 1902.1; Brocchi, P. 1880.1; ★Faber, G. L. 1883.1 (*Gen. treat.*); Gareis, A. 1875.1; ★Krisch, A. 1900.1 (*Gen. treat.*); Marchesetti, C. 1882.1, 1883.1, Add. 1884.1; Paolucci, L. 1901.1; Sucker, L. 1895.1.

See also under surrounding countries.

NETHERLANDS

Publications of the *Ryksinstituut voor het onderzoek der Zee* (Dutch Sea Fisheries Scientific Bureau) are the *Jaarboek* and the *Verhandelingen*. A Dutch journal appears monthly as *Mededeelingen over Visscherij*.

General treatises. Jonge, J. C. 1862.1; ★Redeke, H. C. 1907.2; Reste, B. 1801.1; Richter, J. G. 1768.1, 1780.1; Venema, G. A. 1868.1.

Fisheries statutes, 1235–1871. For list, consult the bibliography of Bosgoed, D. M. 1874.1.

Early references, in Pre-Linn. section. Oudenhoven, J. 1654.1; Riemer, J. 1730.1; Schrassert, J. 1732.1; Smallegange, M. 1696.1; Velius, T. 1740.1.

Fresh-water or inland fisheries. Aalderink, H. 1899.1; Meesters, — 1900.1; Quakernaat van Spijk, A. 1870.1, 1871.1; Roché, G. 1895.1.

Miscellanea; chiefly marine fisheries. Baert, J. F. 1860.1; Beaujon, A. 1885.1; Bogaerde, A. J. 1825.1; Buys, J. T. 1867.1; Dietz, P. A. 1908.1; Eckstein, D. 1885.1; Eeden, F. W. 1875.1; Ehrenbaum, E. 1892.4, 5; Friedel, E. 1871.1; Gramberg, J. S. 1877.1; Guberleth-Plegger, T. 1791.1; Hall, H. C. 1868.1; Harting, J. E. 1878.1; Harting, P. 1852.1, 1854.1; Hasselt, A. W. 1855.1; ★Hoek, P. P. 1890.1–1912.5; Lönnberg, A. J. 1904.3; Macks, J. A. 1870.1; Mohr, N. 1782.1; Molhuijsen, P. C. 1864.1; Piscator, L. 1773.1; Redeke, H. C. 1905.2, 1906.1, 1909.2, 1910.1, 1911.2, 1913.3, 1914.3; Rietstap, G. H. 1870.1; Scheltema, S. P. 1865.1; Ver-veer, M. [n. d.]; Weijland, G. J. 1871.1; Anon. 102, 465, 594.

For Dutch herring fisheries, see Fisheries, Herring, above.

NORTH SEA

See under the surrounding countries such as Belgium, British Isles, Denmark, Germany, Netherlands, and Norway.

For the work of the *International Commission for the Investigation of the Sea*, see above under Commissions of Fisheries.

NORWAY

The annual report of the Fisheries Board of Norway is the *Aarsberetning vedkommende Norgen Fiskerier*. A weekly paper, the *Fiskets Gang*, contains consular reports and statistics. The *Norsk Fiskeralmanak*, published annually at Bergen by the *Selskabet for de norske Fiskeriers Fremme*, should also be consulted.

General treatises: Baars, H. 1873.1, 1880.1; Dannevig, G. M. 1899.1; ★Decker, W., Heincke, F. & Henking, H. 1901.1; Henking, H. 1901.3; ★Hjort, J. 1895.1, 1900.1, 2, Add. 1905.1; ★Hjort & Dahl, 1900.1; Hjort & Gran, H. H. 1900.1; Lilljeborg, W. 1884.1; Loberg, O. N. 1864.1; ★Nordgaard, O. 1908.1, 1911.1. — Review of Hjort, J. 1895.1. Garstang, W. 1897.1.

Bibliography. Boeck, T. 1866.1, 1880.1.

Lofoten Is., Cod fisheries: Backer, F. 1878.1; Badeigts de Laborde, — 1815.1; Brons, B. 1894.1; Ehrenbaum, E. 1904.2; Høye, K. 1902.1; Juel, N. 1880.1, 1884.1; König, C. 1895.1; Laing, S. 1851.1; Maude, A. 1859.1; Meyer, H. 1904.1; Olsen, H. 1865.1; Rom, N. C. 1868.1; Sars, G. O. 1869.1, 1871.1, 1879.5, 6; Falch, M. Add. 1788.1; Jacobi, A. Add. 1913.1.

Fisheries — Cont'd.

"**Michael Sars:**" *Research ship of the Norwegian Bureau for the International Investigation of the Sea; work, etc.* Collett, R. 1903.1, 1909.1; Hjort, J. 1901.1, 4, 1911.1, 2; Iversen, Thor, 1907.1-1909.1; Lea, E. 1913.2; Add. 1913.1; Murray, J. & Hjort, J. 1912.1; Sund, O. Add. 1909.1.

Marine fisheries: (*chiefly*). Albert, F. 1912.2; Ameln, J. 1880.1; Andersen, O. 1868.1, 2, 1872.1; Baars, H. 1862.1-1880.1; Bendixen, B. E. 1868.1; Bergen, H. B. 1873.1; Berthoule, A. 1892.1; Berthoule & Vaillant, 1889.1; Blanchard, C. E. 1882.1; Boeck, A. 1862.1-1875.1; Boeck, G. & Feddersen, J. 1876.1; Bowden, J. 1867.1, 1869.1; Breton, W. H. 1835.1; Broch, H. 1907.1; Broch, O. J. 1876.1, 1882.1; Brunchorst, J. 1889.1, 1898.1; Buch, S. A. 1886.1; Collins, J. W. 1894.2; Dahl, K. 1897.1-1912.1; Dannevig, G. M. 1906.2; Ditten, H. S. 1872.1; Ehrenbaum, E. 1904.2; Feddersen, A. F. 1879.2; Finn, W. 1880.2; Foyn, S. 1879.1; Friedel, E. 1875.1; Friele, H. 1879.1; Friis, N. C. 1770.2, 1771.1, Add. 1770.2, 3, 4, 1778.1; Heincke, F. 1887.1; Heincke, F. & Henking, H. 1900.1; Helland-Hansen, B. & Nansen, F. 1909.2; Hetting, M. G. 1863.2, 1868.1, 2, 1880.1; Hjort, J., Nordgaard, O. & Gran, H. 1899.1; Hjort, J. & Petersen, C. 1905.1; Irgens, A. 1873.1; Kiær, A. N. 1871.1, 1889.1; Larsson-Fede, B. 1908.1; Milne-Edwards, A. 1878.1; Nielsen, — 1909.1; Olsen, H. 1865.1, 1866.1; Perels, — 1871.1; ★Sars, G. O. 1865.1-1894.1; Stellwagen, A. W. 1872.1; Strøm, H. 1762.1, Add. 1782.1; Sundt, E. 1862.1; Thuesens, J. 1865.1; Tilljeborg, W. 1881.1; Wallem, F. M. 1883.1; Watt, W. 1883.2; Wulfsberg, C. A. 1867.1, 1872.1; Anon. 72, 94, 174, 310, 312, 352, 501; Falch, M. Add. 1788.1, 1790.1; Friis, N. C. Add. 1770.1-1778.1; Gunner, J. E. Add. 1767.1; Hjort, J. & Dahl, K. Add. 1899.1; Molberg, C. G. Add. 1790.1; Pérard, J. Add. 1899.1; Walheim, Add. 1877.1.

Pre-Linn. references. Gissler, N. 1748.2-1753.1; Hellant, A. 1738.1.

River fisheries: Hetting, M. G. 1866.1, 2, 3, 1869.1; Huitsfeldt-Kaas, H. 1906.1; Hutchinson, R. D. 1871.1; Landmark, A. 1876.1, 1889.1.

For Norwegian herring and salmon fisheries, see these subjects, under Fisheries, above.

PORTUGAL

Statistics are published annually in the *Estatistica das Pescas Maritimas*.

Ashworth, T. & Ashworth, E. 1857.1; Carvalho, C. 1894.1; Silva, A. B. 1892.1, (*Gen. treat.*) 1898.1; Nobre, A. 1895.2, 3.

RUMANIA

Antipa, G., 1894.1, 1895.1, 1901.1, 1912.1; Maksimov, N. E. 1913.1.

RUSSIA

Fishery statistics are published by the Imperial Ministry of Land and Agriculture annually in a volume entitled *Recueil de Données Statistiques et Economiques caractérisant la situation agricole en Russie*.

General treatises

Baer, K. E. 1853.1; Chmëlevskij, Gracianov, Zograf, and others, 1907.1; Danilevsky, C. 1867.1; Kuznetzov, I. D. 1898.1, 2; Müller, K. 1874.1; Sabanyeev, L. P. 1874.1, 1911.1; Venyaminov, N. 1876.1. — *See also* ★Borodin, N. A. "Pêche et Pisciculture en Russie." Atti del V. Congresso internat. di Pesca, Roma, 1913.

Bibliography. Reuter, O. & Luther, A. 1909.1.

Fresh-water Fisheries

Lake fisheries: Alenitsin, V. D. 1873.1-1880.1; Grimm, O. 1902.1; Kuchin, I. B. 1902.1, 1904.1; Sellheim, H. 1909.1; Zograf, N. Y. 1895.2. — *Lake Peipus.* Zur Mühlen, M. 1908.3, 1911.27.

River fisheries: *Danube R. (mouths of).* Gindce, B. K. 1909.1.

Ural River. Borodin, N. A. 1910.1; Wight, J. 1901.1.

Volga River. Aleksandrov, K. P. 1909.1; Berg, L. S. 1906.3, 9; Golynetz, W. 1907.1; Grimm, O. 1896.1, 1897.1; Ozeretskovski, N. 1813.1; Savostickij, N. G. 1901.1; Varigny, H. C. 1897.1.

Miscellanea

Chorošchin, I. P. 1902.1; Ergomysev, N. 1910.1; Grimm, G. 1892.1; Grimm, O. 1882.1; Lindes, L. 1880.6; Pokrovskii, S. V. 1901.1; Shavrov, N. 1909.1; Zograf, N. Y. 1901.3; Anon. 670; Wiese, J. Add. 1913.1.

Fisheries of Poland before the 16th Century. Sweizawski, E. 1880.1.

Kaiserlichen Russischen Gesellschaft für . . . Fischerei. Arnold, J. N. 1905.1.

Caspian Sea: ★Grimm, O. 1896.1, 1897.1; Kascejev, S. S. 1901.1; Lebedintsev, A. A. 1905.3; Lönnberg, A. J. 1900.8; Nikolskij, A. M. 1898.2; Schultz, A. 1873.1, 1874.1, 1876.1; Semenov, N. V. 1902.1; Meissner, A. I. Add. 1914.1; Suvorov, E. K. Add. 1913.1.

Finland: Böök, A. T. 1892.1; Carenius, E. 1759.1; Corchus, B. 1898.1; Deutsch, D. H. 1819.1; Durchman, J. O. 1899.1; Enwald, R. 1892.1; Ericsson, B. 1900.1-1904.1; Essen, C. J. 1897.1, 1898.1; Forsström, K. 1893.1, 1897.1; Gadd, P. A. 1789.1; Genetz, A. T. 1897.1, 1899.1; Gustafsson, H. 1897.1; Gutzén, H. I. 1895.1; Hällström, R. 1902.1; Hildebrand, W. 1897.1; Holmberg, H. J. 1859.2, 1861.1-1863.2; Jalkanen, J. 1893.1; Julin, J. 1789.1, 1792.1, 1800.1; Korpela, J. E. 1893.1; Koskinen, Y. 1852.1; Laitinen, A. 1892.1-1900.1; Levander, K. M. 1893.2; Limborg, H. 1894.6; Lindfors, A. M. 1895.1; Loberg, O. N.

1867.1; Malmgren, A. J. 1869.2, 6, 1885.1, 1887.1; Näs, J. 1895.1–1900.1; ★Nordqvist, O. F. 1890.1–1906.1; Palander, L. 1767.1; Räihä, — 1893.1; Rein, G. 1864.1, 1867.1; Reuter, O. O. 1889.1–1896.1, 1900.1; Rosberg, J. E. 1891.1–1900.2; Roschier, — 1826.1; Rosendal, P. 1893.1; Runeberg, E. O. 1758.1; Ryder, J. A. 1896.2; Salenius, J. M. 1871.1; Sandman, J. A. 1892.1–1900.1; Sars, G. O. 1868.2; Saurén, H. 1895.1; Schneider, G. 1902.5, 1904.2, 8, 1905.3; Sjöberg, H. R. 1895.1–1903.1; Snellman, R. W. 1899.1, 2; Stabrowski, X. 1894.1; Stadius, A. 1893.1; Stenbäck, J. 1894.1; Stiervald, C. F. 1774.1; Tammelander, A. 1893.1; Ticcander, M. 1792.1; Wallenius, E. 1896.1, 1898.1; Wallenius, J. F. 1814.1; Warelus, A. 1855.1; Wikberg, E. 1895.1.

Aland Islands. Forsberg, A. 1893.1–1899.1; Holmberg, H. J. 1859.1; Nordström, J. A. 1900.1; Oehberg, A. 1897.1; Willebrand, K. F. 1864.1.

Lapland: Breitfuss, L. L. 1905.1; Fabritius, W. 1910.1; Hellander, A. 1772.1; Lidbeck, E. G. 1764.1; Schultz, A. 1873.1, 1874.1, 1876.1; Stjernvall, H. J. 1893.1; Tornaeus, J. J. 1772.1; Hallström, G. Add. 1911.1.

N. W. Russia: *Chiefly Archangel Govt. and Baltic Provinces.* Ekman, F. J. 1847.1; Golubcov, N. A. 1910.1; Grimm, O. 1902.1, 1905.3; Knipovich, N. M. 1897.1; Samsonov, N. A. 1910.1; Schneider, G. 1903.9, 1909.10, 1910.2; Tiesler, W. 1903.1; Zur Mühlen, M. 1911.27; Anon. 223.

SPAIN

General treatises. Ashworth, T. & Ashworth, E. 1857.1; Pardo y Puzo, A. 1907.1; Salas, J. & García Solá, F. 1876.1; ★Sañez Reguart, A. 1791.1; Valverde, —. 1879.1. — *See also* ★ "Monographie de la pêche maritime en Espagne." Stenograph. Protokoll, Verhandl. internat. Fischerei-Kongresses, Wien, 1905 (1906).

Bibliography. Jordana y Morera, J. 1873.1.

Various references. Albert I, H. C. 1887.2; Alonso Lopez, J. 1820.1; Amengual, R. 1912.1; Borja y Goyeneche, J. 1902.1, Add. 1907.1; Cisternas, R. 1867.1; Cornide, J. 1774.1–1788.1; García Solá, F. 1883.1; Graells, M. 1869.2; Larruga, D. E. 1798.1; Nava y Caveda, H. 1878.1; Reed, D. T. 1885.1; Fernandez, C. Add. 1850.1, 1868.1.

SWEDEN

The work of the Swedish section of the International Commission is published in the *Svenska Hydrografisk-biologiska Kommissioners Skrifter*. The reader should consult also a monthly journal, the *Svensk Fiskeritidskrift* published at Stockholm, and a fortnightly paper, the *Fiskerierna*, published at Göteborg.

General treatises. Cederström, G. C. 1857.1; Ekström, C. 1830.1, 1835.1

(*Mörkö Skärgård*); ★Lilljeborg, W. 1884.1; Limborg, H. 1880.1; ★Lundberg, R. 1886.1; Nordqvist, O. F. 1911.3; S., T. S. 1778.1; Sundström, C. R. 1886.1; Widegren, H. 1866.1; Yhlen, G. 1880.1.

International fisheries conference at Stockholm, June 15–23, 1899. Allen, E. J. 1899.1.

Lake and river fisheries. Hetting, M. G. 1866.3; Klingspor, D. M. 1911.1; Limborg, H. 1894.1–5, 7, 1895.1; Ling, J. A. 1901.1.

Miscellanea, chiefly marine fisheries. Andersen, O. 1868.1, 2, 1872.1; Andrée, A. 1850.1; Annerstedt, L. 1894.1; Ekström, C. 1850.1; Friedel, E. 1875.1; ★Lönnberg, A. J. 1894.7, 1895.1, 1897.2, 1899.4, 1900.9, 1907.3, 1911.4; Lundberg, R. 1886.1–1899.1; Nordqvist, O. F. 1911.3, 1912.2; Reuter, O. O. 1889.1; Schneider, G. 1909.2, 7; Smitt, F. A. 1883.1; Tilljeborg, W. 1881.1; Trybom, F. 1887.2, 1901.1, 1903.1; Wahlberg, Y. Y. 1903.1; Wheelwright, H. W. 1864.1; Widegren, H. 1860.1–1880.1; Wollebæk, A. 1904.1, 1905.1; Anon. 679; Marin, G. Add. 1774.1, 1781.1; Strøm, H. Add. 1782.1.

Pre-Linn. references. Brander, F. R. 1751.1; Carleson, E. 1754.1; Enholm, J. E. 1753.4; Eslenberg, C. 1750.1.

For Swedish herring fisheries (chiefly of Bohuslän), see under Fisheries, Herring, above.

SWITZERLAND

Bibliographies. Coaz, J. 1883.1, 1898.1; Anon. 244.

Miscellanea, reports, statistics, etc. Asper, G. 1883.1–1891.1; Borne, M. 1882.1; Estermann, W. 1875.1; Fankhauser, F. 1906.1; Fuhrmann, O. 1904.2, 3, 1906.1; Gloenkler, K. 1895.1; Goll, H. 1893.1, 2; Heuscher, J. 1897.1; Hofer, J. 1897.1; ★Liebenau, T. 1893.1–1897.1; Madörin, A. 1885.1; Merz-Diebold, W. 1896.1; Plattner, S. 1879.1; Salis, S. R. 1893.1; Schinz, H. R. 1787.1; Schoch, G. 1890.2, 1891.3, 1893.2, 1896.1; Sulzer, J. 1880.1; Surbeck, G. 1910.3, 1911.10, 1915.1, 4; Weith, W. 1880.1; Wittmack, M. C. 1875.1; Anon. 244, 383, 577.

Lake fisheries: Heuscher, J. 1893.2, 1901.1, 1903.1, 2, 1906.1; Zacharias, E. O. 1905.2. — *Lake of Bienné.* Hirt, F. 1896.1, 1897.1. — *Neuchâtel Lake.* Savoie-Petitpierre, — 1901.1. — *Sarnen Lake.* Kuechler, A. 1895.1. — *Sempacher See.* Heuscher, J. 1895.1; Liebenau, T. [n. d.]; Zwimpfer, L. 1869.1. — *Thunersee.* Gilleron-Fuhrer, — 1894.1; Heuscher, J. 1901.1, 1903.1; Türler, H. 1895.1. — *Wallensee.* Heuscher, J. 1905.2; Steinmüller, J. R. 1827.1. — *Lake of Zug.* Heuscher, J. 1893.1.

Lake of Constance (Bodensee). Coaz, J. 1892.1; Hartmann, W. 1870.1; ★Heuscher, J. 1903.1, Add. 1911.1; Hirn, R. 1896.1; Läubli, G. 1880.1; Metz, A. 1888.1; Mörikofer, J. C. 1853.1; Nenning, S. V. 1834.1; Nüsslin,

Fisheries — Cont'd.

O. 1882.2, 1907.3; Rauch, G. 1896.1; Schoch, G. 1895.1; Stoffel, F. 1906.1; Surbeck, G. 1904.2, 1914.1, 1915.3, 1916.1; Anon. 678; Strigel, A. Add. 1910.1.

Lake Geneva. Dessaix, J. 1868.1; Forel, F. A. 1901.3, 1906.2, 1909.1; Frossard de Saugny, E. 1884.1; Lugrin, Fr. 1893.1; Naville, Add. 1762.1, 2.

Various localities: *Appenzell (Canton).* Heuscher, J. 1894.3. — *Basel (Canton).* Schönberg, G. 1879.1; Surbeck, G. 1915.2; Vetter, J. 1864.1 (*Gen. treat.*); Anon. 222. — *Schaffhausen (Canton).* Moser-Ott, — 1880.1, 2. — *St. Gall (Canton).* Heuscher, J. 1894.2; Naegeli, L. & Mächler, A. 1899.1; Pfyffer, C. 1858.1; Schoch, G. 1890.3; Wartmann, F. B. 1868.1; Wulpillier, P. (*History*) 1896.1. — *Ticino (Canton).* Pavesi, P. 1871.1; Regazzoni, I. 1864.1. — *Vaud (Canton).* Bridel, — 1818.1; Matthey, L. 1880.2, 1883.1. — *Zug (Canton).* Wickart, A. (*Gen. treat.*) 1891.1. — *Zürich (Canton).* Heuscher, J. 1894.1, 1905.2; Hulftlegger, H. 1891.1, 1893.1, 1896.1, 1904.1; Meister, U. 1894.1; Escher, H. Pre-Linn. 1692.1.

TURKEY

Der Fischmarkt in Konstantinopel. Schleiff, V. 1902.1.

OCEANICA

Native fishing in various island groups of Oceanica. Alexander, A. B. 1902.1.

Australia: (including *Tasmania*). Alexander, J. E. 1869.2, 4; Brown, G. 1912.1; Waite, E. R. 1900.2; Kent, W. S. Add. 1897.1. — See also ★T. C. Roughley "Fishes of Australia and their Technology." Sydney, 1916. 296 p. pls.

New South Wales. Collins, J. W. 1883.2; Ramsay, E. P. 1883.3; ★Stead, D. G. 1908.1, 1910.1, 1911.3; ★Thompson, L. G. 1893.1; Waite, E. R. 1898.1, 2; Willey, A. 1908.1; ★Woods, J. E. 1882.1, 1888.1; Zietz, A. 1902.1.

Queensland. Ogilby, J. D. 1913.1, 1915.2.

Tasmania. Allport, M. 1869.2; Johnston, R. M. 1890.1; Spencer, O. M. 1885.1.

Victoria. Castelnau, F. L. 1872.2, 1874.1; Lang, G. S. 1864.2.

Dutch East Indies: Koningsberger, J. C. 1907.1; Sunier, A. L. 1914.1; Verloop, G. N. 1904.1, 2; Weber, M. 1913.1; Anon. 711, 712; Knebel, C. Add. 1881.1; Popta, C. Add. 1905.1.

Borneo. Low, H. 1848.1.

Java. Roosendaal, A. M. 1910.1, 2; M., Add. 1905.1.

New Guinea. Erdweg, P. M. Add. 1902.1.

Sumatra. ★Kampen, P. N. 1908.2, 1909.1, 2; Marsden, W. 1811.1.

Hawaiian Is.: Beckley, E. M. 1883.1, Add. 1887.1; ★Cobb, J. N. 1902.1, 1909.2, 1912.2; Jordan, D. S. & Evermann, B. W. 1902.2.

New Zealand: Brown, G. 1912.1; Thomson, G. M. 1898.1; Thomson, P. 1877.1, 1879.1.

Philippine Is.: Seale, A. 1908.1, 1911.1.

Samoa Is.: Demandt, E. Add. 1913.1.

FISHING METHODS

See also section on Angling.

For apparatus used in commercial fisheries, such as seines, nets, boats, etc., see Apparatus & Appliances, under Fisheries.

For prehistoric fishing implements, see under Archaeology.

For a valuable recent work in English, with chapters including discussions of the first use of the artificial fly and rod, and curious methods of fishing, etc., among the Greeks, Romans, Egyptians, and Assyrians, see ★Wm. Radcliffe. "Fishing from the earliest times." London. 1921. 478 p. pls.

Fishing methods used by primitive peoples. Riccardi, P. 1879.1; Frobenius, L. Add. 1902.1; Lafitte, J. P. Add. 1912.1.

Earliest figure of use of float. Anon. 737.

Use of gourd rattles to attract fish, in Indian Archip. — Earl, G. W. Add. 1837.1.

Diving and catching fishes by hand in the Philippines. Jenks, A. E. Add. 1905.1.

Dolphin as aid in fishing. Ascherson, P. 1892.1.

Ice fishing. — *In Alaska.* Bean, T. H. 1890.15. — *For pickerel.* Chalmers, T. 1879.4. — *For smelts.* Cheney, A. N. 1876.1. — *In Sweden.* Rosenhane, G. Pre-Linn. 1681.1.

Baits and Lures

Ehrenbaum, E. 1896.2; Evermann, B. W. 1901.1, 1902.3; Wilcocks, J. C. 1883.1. — *Artificial baits.* Hughes, F. 1891.1. — *Narcotized fishes for bait, in New Britain.* Pullen-Burry, B. Add. 1909.1.

Rogue, used in sardine fisheries. Cépède, C. 1910.4; Landrieu, G. 1904.1; Smith, H. M. 1902.4.

Spider-web lure, used chiefly in New Guinea. Coombe, F. Add. 1911.1; Lehner, S. Add. 1911.1; Neuhauss, R. Add. 1911.1.

Cormorant Fishing

Chiefly in China and Japan. Courcy, — 1866.1; Harting, J. E. 1883.1; Jouy, P. L. 1888.1; Le Couteulx de C., J. 1870.1; ★Leonhardt, E. E. 1901.1; Ball, J. D. Add. 1900.1, 1904.1; Doolittle, J. Add. 1865.1; Freeman, G. E. & Salvin, F. H. Add. 1859.1; Gordon-Cumming, C. F. Add. 1887.1. — *Pre-Linn. refs.* Clusius, C. 1605.1. *First ref.* Odoric of Pordenone. 1513.1.

Diving goose (Merganser), in Sweden. Ilström, J. Pre-Linn. 1749.1.

Explosives

Dynamite and nitro-glycerine used to kill fishes. Baird, S. F. 1871.25, 1874.5; Chase, A. W. 1874.2; Knight, A. P.

1907.1; Albertis, L. Add. 1881.1. — *Effects on study specimens.* Vaillant, L. L. 1896.1.

Hook and Line Fishing

Chiefly native methods in South Seas and Indian Archipelago. Beccari, O. Add. 1904.1; Christian, F. W. Add. 1899.1; Earl, G. W. Add. 1837.1; Ellis, W. Add. 1829.1, 1853.1; Finsch, O. Add. 1888.1; Forrest, T. Add. 1779.1; Haddon, A. C. Add. 1904.1; Hedley, C. Add. 1896.1, 1897.1; Jacobsen, J. A. Add. 1896.1; Kubary, J. S. Add. 1889.1; Moerenhout, J. A. Add. 1837.1; Parkinson, R. Add. 1907.1; Pfeil, J. Add. 1899.1; Powell, W. Add. 1884.1; Schmeltz, J. D. Add. 1881.1.

Use of pearl-shell hook, chiefly for Bonito, in southern Pacific Is. Becke, L. Add. 1897.1–1909.1; Grimshaw, B. Add. 1907.1; Jacobs, T. J. Add. 1884.1; Woodford, C. M. Add. 1890.1.

Thorns used instead of hooks. Arderon, W. Pre-Linn. 1748.3.

Kite Fishing

Chiefly in the South Seas. Balfour, H. Add. 1913.1; Codrington, R. H. Add. 1891.1; Coombe, F. Add. 1911.1; Hardy, N. H. & Elkington, E. W. Add. 1907.1; Parkinson, R. Add. 1907.1; Penny, A. Add. 1887.1; Wawn, W. T. Add. 1893.1.

In East Indies. Jacobsen, J. A. Add. 1896.1; Reinwardt, C. G. Add. 1858.1; Skeat, W. W. Add. 1900.1.

In New Guinea. MacGregor, W. Add. 1897.1, 1898.1; Murray, J. H. Add. 1912.1.

In the Solomon Is. Edge-Partington, T. W. Add. 1912.1; Guppy, H. B. Add. 1887.1; Parkinson, R. Add. 1899.1, 1907.1; Ribbe, C. Add. 1903.1.

Lights, Fires, Torches, etc.

Employed in attracting or blinding fishes. Baird, S. F. 1875.18; MacCulloch, J. 1826.2; Russo, A. 1913.1; Bean, T. H. Add. 1884.2; Haddon, A. C. Add. 1904.3; Ricci, J. H. Add. 1875.1; Rivers, W. H. Add. 1914.1; Anon. 715; Fournival, R. Pre-Linn. 1470.1; Scheffer, H. T. Pre-Linn. 1750.1; Seländers, N. Pre-Linn. 1744.1.

Fishing with luminous bait. Police, G. 1910.2, 1912.1.

Nets of Native Peoples

Chiefly in South Sea islands. Albertis, L. M. Add. 1881.1; Biró, L. Add. 1905.1; Coulter, J. Add. 1845.1; Ellis, W. Add. 1829.1, 1853.1; Grimshaw, B. Add. 1907.1; Jacobsen, J. A. Add. 1896.1; Pfeil, J. Add. 1899.1; Ricci, J. H. Add. 1875.1; Schmeltz, J. D. Add. 1881.1; Seligmann, C. G. Add. 1910.1; Chomel, N. Pre-Linn. 1718.1; Peyer, J. C. Pre-Linn. 1687.1. — *In India.* Hooker, J. D. Add. 1854.1. — *In China Sea.* Jacobs, T. J. Add. 1884.1. — *Caroline Is.* Kubary, J. S. Add. 1889.1. — *Solomon Is.* Woodford, C. M. Add. 1890.1.

Spider-web nets. Codrington, R. H. Add. 1891.1; Hardy, N. H. & Elkington, E. W. Add. 1907.1. — *In the Solomon Is.* Guppy, H. B. Add. 1887.1. — *In New Guinea.* Meek, A. S., Add. 1913.1; Pratt, A. E. Add. 1906.1; Rawling, C. G. Add. 1913.1; Williamson, R. W. Add. 1912.1, 1914.1.

For popular articles giving a complete résumé of the use of the spider-web net by native fishermen in New Guinea, see E. W. Gudger, in Bull. N. Y. Zool. Soc. 1918, vol. 21, pp. 1588–1590, 1687–1690.

Otter Fishing

Freeman, G. E. & Salvin, F. H. Add. 1859.1. — *In China.* Gordon-Cumming, C. F. Add. 1887.1. — *In India.* Hooker, J. D. Add. 1854.1. — *Pre-Linn. refs.* Low, J. 1752.1; — *Earliest account.* Mandeville, J. 1480.1.

POISONOUS PLANTS

Their use in killing fishes

General treatises. ★Greshoff, M. Add. 1893.1; ★Radlkofer, L. Add. 1886.1; Schaer, E. Add. 1901.1. — *Review of Greshoff.* Mitchell, C. A. Add. 1906.1.

Timbo. Haseman, J. D. & Eigenmann, C. H. 1911.1. — *Spurge, Euphorbia hiberna.* Kyle, H. M. 1901.2. — *Poisoning of fishes by American Indians.* Hodge, F. W. Add. 1910.1. — *In India.* Hooker, J. D. Add. 1854.1. — *Fishing with the poison creeper (Paullinia pinnata L.) in the Amazon and Madeira rivers.* Keller, F. Add. 1874.1. — *Poisoning fish with Dirca palustris.* Livingstone, D. & Livingstone, C. Add. 1866.1. — *In Mexico, with polygonum, amole, soke, and palo de la flecha.* Lumholtz, C. Add. 1902.1. — *Plant lactones as fish poisons.* Preiss, Add. 1911.1. — *Verbascum. Chemical researches.* Rosenthaler, L. Add. 1902.1. — *Stephania hirnandiaefolia of Australia.* Shirley, J. Add. 1895.1. — *With the chilpate (Sapindus saponaria) in Honduras.* Wells, W. V. Add. 1857.1.

In Africa. Cardoso, J. 1897.1; Lang, H. 1915.1; Brielman, P. Add. 1901.1; Burrows, G. Add. 1898.1; Livingstone, D. Add. 1858.1.

In Australia. Banfield, E. J. Add. 1913.1; Palmer, E. Add. 1884.1. — *Fish-poisons of the Australian aborigines.* Maiden, J. H. Add. 1894.1. — *Poisoning fishes with Eucalyptus in eastern Australia.* Mitchell, T. L. Add. 1837.1. — *With Duboisia, in Australia.* Thomas, N. W. Add. 1906.1.

In various islands of the southern Pacific Ocean. Adams, A. Add. 1848.1; Biró, L. Add. 1901.1; Codrington, R. H. Add. 1891.1; Ellis, W. Add. 1829.1, 1853.1; Guppy, H. B. Add. 1887.1; Haddon, A. C. Add. 1904.3; Jacobsen, J. A. Add. 1896.1; Kubary, J. S. Add. 1889.1; Lehner, S. Add. 1911.1; Meek, A. S. Add. 1913.1; Moerenhout, J. A. Add. 1837.1; Neuhauss, R. Add. 1911.1; Parkinson, R. Add. 1899.1; Pauwels, W. M. Add.

Fishing Methods — Cont'd.

1903.1; Powell, W. Add. 1884.1; Ribbe, C. Add. 1903.1; Rivers, W. H. R. Add. 1914.1.

Barbasco, used in South America. Castelnau, F. L. 1855.1; Ernst, A. 1881.1; Marcoy, P. 1869.1; Orton, J. 1870.1.

Barringtonia, used chiefly in Fiji Is. Brown, G. Add. 1910.1; Ricci, J. H. 1875.1; Seemann, B. Add. 1862.1.

Cyclamen, used in marine fishing. Costa, A. 1870.1; Jourdain, S. 1878.2.

Tephrosia, used in southern Pacific. Brown, G. Add. 1910.1; Hanriot, M. Add. 1907.1-Add. 1907.3; Roth, W. Add. 1897.1.

"Tuba." (Derris). Low, H. 1848.1; Christian, F. W. Add. 1899.1; Hornaday, W. T. Add. 1888.1; Murray, J. H. Add. 1912.1; Walker, H. W. Add. 1910.1. — *In Sulu*. Forrest, T. Add. 1779.1. — *In Fiji Is.* Ricci, J. H. 1875.1; Seemann, B. Add. 1862.1. — *In Sumatra*. Schneider, G. Add. 1906.1.

Use of tuba in Borneo. Beccari, O. Add. 1904.1; Gomes, E. H. Add. 1911.1; Haddon, A. C. Add. 1901.1; Hose, C. & McDougall, W. Add. 1912.1; Nieuwenhuis, A. W. Add. 1900.1, 1904.1; Roth, H. L. Add. 1896.1; St. John, S. Add. 1844.1; Treacher, W. H. Add. 1889.1; Walker, H. W. Add. 1910.1.

REMORA OR ECHENEIS**Use of the shark-sucker**

For a recent comprehensive summary, see ★E. W. Gudger in *Amer. Nat.*, 1919, vol. 53, pp. 289-311, 446-467, 515-525.

Brassey, A. 1885.1; Brussel, T. 1798.1; Bullen, F. T. 1904.2; Dampier, W. 1906.1; Eastman, C. R. 1915.1, Add. 1916.3; Gosse, P. 1851.1; Holder, C. F. 1899.4, 1905.2, Add. 1899.1; Holmwood, F. 1884.1, Add. 1883.1; Humboldt, F. H. 1805.1, 1852.1; Kent, W. S. 1893.1; Meier, H. 1861.1; Pocock, W. I. 1912.1; Poey, F. 1851.1; Pollen, F. P. 1868.1; Selous, E. 1911.1; Semon, R. W. 1896.2, 1899.1, 1903.1; Sibree, J. 1915.1; Winkler, T. C. 1859.1; Bachiller y Morales, A. Add. 1883.1; Banfield, E. J. Add. 1913.1; Cobo, B. Add. 1891.1; Gill, W. W. Add. 1876.1; Haddon, A. C. Add. 1889.1-1904.1; Hudson, C. B. Add. 1893.1; MacGillivray, J. Add. 1846.1; Meek, A. S. Add. 1913.1; Oliver, S. P. Add. 1909.1; Roth, H. L. Add. 1889.1; Roth, W. E. Add. 1901.1; Selater, P. L. Add. 1889.1; Thomas, N. W. Add. 1906.1; Wills, J. Add. 1897.1.

Pre-Linn. accounts. Eden, R. 1555.1; Gomara, F. 1578.1; Herrera, A. 1601.1; Martyr, P. 1504.1; Oviedo y Valdez, G. F. 1525.1; Ramusio, G. B. 1606.1.

TRAPS FOR FISHES

In South Sea Islands. Earle, E. M. 1890.1; Batchelor, J. Add. 1892.1; Biró, L. Add. 1905.1; Codrington, R. H. Add.

1891.1; Haddon, A. C. Add. 1904.1; Jenks, A. E. Add. 1905.1; Layard, E. L. Add. 1853.1; Parkinson, R. Add. 1899.1; Pfeil, J. Add. 1899.1; Sirelius, U. T. Add. 1906.1; Brauner, J. Pre-Linn. 1753.1.

**METHODS OF TAKING
VARIOUS FISHES**

Dolphin as an aid in capture of mullet. Ascherson, P. 1892.1. — "*Bucskalo*," a sounding device to attract the Wels (*Silurus glanis*) in Danube and Serbia. Bayer, J. 1863.1. — *Lance for spearing pike*. Weiss, -. 1880.1. — *Eel fishing with "Hommor" on the Baltic coast of Sweden*. Lundberg, R. Add. 1885.1.

Catching carp. Smiley, C. W. 1884.14. — *Catching carp with hands*. Templer, J. Pre-Linn. 1673.1.

Shark catching. *In Arctic seas*. Nordenskiöld, A. Add. 1879.1; Olaffen, O. Add. 1781.1; Knutberg, C. Pre-Linn. 1755.1.

Diving, "tickling" and noosing sharks in South Seas. Cobb, J. N. 1902.1; H., L. 1876.1; Reitsma, A. J. 1868.1; Gill, W. W. Add. 1876.1; Gordon-Cumming, C. Add. 1882.1; Grimshaw, B. Add. 1907.1; Pritchard, W. T. Add. 1866.1.

Noosing sharks on the surface of the water. Beckley, E. M. 1883.1; Becke, L. Add. 1897.1; Codrington, R. H. Add. 1891.1; Coombe, F. Add. 1911.1; Finsch, O. Add. 1888.1; Hartzer, F. Add. 1900.1; Kubary, J. S. Add. 1889.1; Parkinson, R. Add. 1899.1, 1907.1; Powell, W. Add. 1884.1; Stair, J. B. Add. 1897.1; Wilkes, C. Add. 1845.1; Wilson, J. Add. 1799.1.

VARIOUS NATIVE METHODS

African methods. Alluaud, C. 1904.1; Burrows, G. Add. 1898.1; Stow, G. W. Add. 1905.1.

Fishing methods of Asia. *China and Japan*. See also above, under *Cormorant*. Dabry de Thiersant, P. 1872.1; Girard, O. 1869.1; Gray, J. H. Add. 1878.1; Du Halde, J. B. Pre-Linn. 1736.1; Montanus, A. Pre-Linn. 1669.1.

East Indies. See also above, under *Tuba*. Reichelt, J. 1906.4; Adams, A. Add. 1848.1; Earl, G. W. Add. 1837.1; Eeckhout, R. A. Add. 1905.1; Hasselt, A. L. Add. 1882.1; Hickson, S. J. Add. 1889.1; Jacobsen, J. A. Add. 1896.1; Moerenhout, J. A. Add. 1837.1; Raffles, T. S. Add. 1830.1; Skeat, W. W. & Blagden, C. O. Add. 1906.1.

New Guinea and Bismarck Archip. See also above, under *Spider-web nets*. Clercq, F. S. A. & Schmeltz, J. D. E. Add. 1893.1; Erdweg, P. M. Add. 1902.1; Finsch, O. Add. 1888.1; Friederici, G. Add. 1912.1; Gill, W. W. Add. 1876.1, 1885.1; Haddon, A. C. Add. 1904.1; Hardy, N. H. & Elkington, E. W. Add. 1907.1; MacGregor, W. Add. 1897.1; Parkinson, R. Add. 1887.1; Romilly, H. H. Add. 1889.1; ★Sande, G. Add. 1907.1.

South America. *In the Guianas.* André, E. Add. 1904.1; Anon. 673. — *In Amazonian basin.* Koch-Grünberg, T. Add. 1908.1; Woodroffe, J. F. Add. 1914.1.

South Sea Islands. Alexander, A. B. 1902.1; ★Becke, L. Add. 1897.1–1909.1; Brown, G. Add. 1910.1; Christian, F. W. Add. 1910.1; Coulter, J. Add. 1845.1; ★Demandt, E. Add. 1913.1; Edge-Partington, J. & Heape, Ch. Add. 1890.1; Ellis, W. Add. 1829.1, 1853.1; Erdland, P. A. Add. 1914.1; Forster, J. R. Add. 1778.1; Hardy, N. H. & Elkington, E. W. Add. 1907.1; ★Krämer, A. Add. 1903.1, 1906.1; ★Kubary, J. S. Add. 1889.1; ★Parkinson, R. Add. 1899.1, 1907.1; Penny, A. Add. 1887.1; Reche, O. Add. 1913.1; Rivers, W. H. R. Add. 1914.1; Schmeltz, J. D. Add. 1881.1; Thomson, B. Add. 1908.1; Walker, H. W. Add. 1910.1; Wilson, J. Add. 1799.1.

Other localities. — *The fishing Indians of Vancouver Island.* Bogge, E. B. 1870.1. — *Fishing methods in Mexico.* Lumholtz, C. Add. 1902.1. — *In North Queensland.* Roth, W. E. Add. 1901.1. — *West Indies.* Acosta, J. Pre-Linn. 1589.1.

FLYING FISHES AND THEIR FLIGHT

For other methods of progression, such as swimming, etc., see under Locomotion.

General articles on flight in vertebrates, including fishes. Dollo, L. 1889.2; Lull, R. S. 1906.1; Hankin, E. H. Add. 1914.1.

General papers on the mechanism and manner of flight in fishes. ★Ahlborn, C. G. 1895.1; Dahl, F. T. 1891.1, 1892.1; ★Durnford, C. D. 1906.1, 2; ★Gill, T. N. 1905.2, 1907.7; ★Möbius, K. A. 1878.1; Seitz, A. 1890.1, 1891.1; Whitman, C. O. 1880.1, 2.

Experimental researches with trial models, etc., into the mechanics of flight in fishes. ★Hoernes, H. 1913.3; Houssay, F. 1911.1; Lilienthal, G. 1911.1; Schlesinger, G. 1912.1.

Fossil flying fishes; their structure as shown by their remains, their geological history, etc. ★Abel, O. 1905.2, 1912.2; Young, G. W. 1915.1; Lydekker, R. Add. 1906.2, 3.

The probable flight of the fossil forms Cheirothrix and Megistopus. Landois, H. 1894.1.

Present day marine flying fishes, their structure and habits of flight. — *Exocætus.* Barrett-Hamilton, G. E. 1903.1; Collingwood, C. 1868.2; Crossland, C. 1911.1; Jullien, J. 1878.1; Krause, E. H. 1888.1; Ridewood, W. G. 1913.1; Winkler, T. C. 1858.2; Zur Mühlen, M. 1911.6. — *Dac-ylopterus.* Calderwood, W. L. 1890.1.

Presumed or alleged power of flight — in the African fresh-water "butterfly fish," Pantodon. Pellegrin, J. 1906.12. — *in the South American fresh-water Characin, Gastroleucus.* Ridewood, W. G. 1913.1.

Smaller articles on flying fishes and their flight, mainly anecdotal, incidental and popular in their nature.

Text in — Danish. Eggers, H. F. 1878.1. — *French.* Gentil, W. 1781.1. — *Dutch.* Winkler, T. C. 1858.2.

Text in English. Adams, L. E. 1906.1, 1909.1; Baird, G. W. 1886.1; Carpenter, A. 1886.1; Ewbank, T. 1853.1; Hadfield, H. 1881.1; Hartt, C. F. 1867.1; Jordan, D. S. 1880.2, 1907.2; Kneeland, S. 1871.1, 1872.1; Mann, H. 1866.1; Matthew, G. F. 1873.1; Mitchell, R. W. 1885.1; Nye, W. 1885.1; Pembroke, — 1872.1; Rendall, P. 1912.1; Smith, F. 1875.1; Vaughan, M. 1907.1; Anon. 676; Barrows, W. B. Add. 1883.1; Broun, A. D. Add. 1881.1; Carney, G. J. Add. 1883.1; Collingwood, C. Add. 1868.1; D'Urban, W. S. Add. 1881.1; Galloway, W. Add. 1892.1; Pascoe, F. P. Add. 1881.2; Taylor, R. E. Add. 1881.1.

Text in German. Danckelmann, E. 1880.1; Du Bois-Reymond, R. 1891.1, 1894.1; Haase, E. 1892.1; Heinrich, Aug. 1879.1; Leonhardt, E. E. 1907.3; Müller, K. 1873.1; Rüst, — 1893.1; Anon. 240, 571.

FOOD AND FEEDING HABITS (OF FISHES)

In the sense of natural sustenance, as shown by their stomach contents and including habits of feeding.

For the proper food for fishes in cultivation, see Food and feeding-methods under Pisciculture.

For the stones often found in stomachs of fishes, see Gastroliths.

For related topics, see Assimilation under Physiology, and also Digestion.

For a general treatise on the entire subject of nutrition, including, however, little on food per se, see ★Biedermann, W. Add. 1911.1.

Miscellaneous and general papers on the food of fishes.

Text in English. Carr, A. M. 1908.1; Goode, G. B. 1883.1; Knox, R. 1855.2; Robertson, D. 1890.1; Sim, G. 1883.1; Wilson, G. 1893.1; Zacharias, E. O. 1887.1; Baird, S. F. Add. 1874.1; Cornish, C. J. Add. 1896.1.

Text in German. Dröscher, W. 1897.1; Lipschütz, A. 1911.2; Anon. 247; Leuchs, J. C. Add. 1817.1.

Text in — Russian. Grimm, O. 1901.2, 3. — *French.* Guignon, — 1903.1; Vion, R. 1883.1. — *Italian.* Toni, G. B. 1900.1, 1908.1. — *Dutch.* Redeke, H. C. 1905.4; Winkler, T. C. 1871.3.

Influence of food upon — Length of intestine. Babák, E. 1903.1. — *Quality of flesh.* Huitsfeldt-Kaas, H. 1901.1. — *Form.* Walter, E. 1911.1.

Food makes no difference in variation of Perch. Walton, L. B. 1907.1.

For influence of food upon coloration, see under Coloration.

Feeding experiment on Pagrus in captivity. Seno, H. & Aoki, T. 1910.1.

Feeding habits

Miscellaneous notes, observations, etc., on the feeding habits of fishes. Anderson, A. 1871.1; Bateson, W. 1892.1; Bonvoisin,

Food — Cont'd.

L. 1877.2; Drzewina, A. 1908.2; Elmhirst, R. 1909.1; Herrick, C. J. 1902.1; Vion, R. 1877.1.

Feeding habits of various fishes. — *Mackerel.* Bullen, G. E. 1912.1. — *North Sea fishes (Pleuronectes, et alii).* Franz, V. 1910.9. — *Gasterosteus.* Anon. 430. — *Clupea.* Swithinbank, H. & Bullen, G. E. Add. 1913.1. *Gadus.* Trachmann, C. O. Add. 1889.1.

Ability of the deep-sea fish with an extensible stomach (Chiasmodon niger) to swallow another fish larger than itself. Carte, A. 1866.1, 2; Goode, G. B. & Bean, T. H. 1896.1 (p. 292); Günther, A. C. 1866.8; Gill, T. N. Add. 1875.1.

Rumination in Scarus, alleged since the time of Aristotle, disbelieved. Houghton, W. 1867.1. — *Description in Scarus of lateral pharyngeal pouches presumed to serve for food storage.* Sagemehl, M. 1885.1. — *Note on this.* Breitenbach, W. 1885.1.

An œsophageal structure presumed to permit rumination in Catla buechanani is described by Hyrtl, C. J. 1864.2.

See also Voracious habits of various predatory fishes under Predatory fishes.

Food of fossil fishes

Crustacea in abdominal cavities of fossil fishes. Deslongchamps, J. A. 1866.1.

Fossil fishes with ingested Saurian remains. Eastman, C. R. 1911.2.

Kinds of food

Chub picking flies from cattle. Moodie, R. L. 1909.1.

Fishes picking mites from skin of men who lie immersed in the stream for that purpose. Anon. 235.

Fishes eating. — *Crustacea.* Forbes, S. A. 1878.7. — *Oysters.* Deyrolle-Guillou, — Add. 1910.1; Pearson, J. Add. 1913.1. — *Medusæ.* Eisig, H. Add. 1884.1. — *Insects.* Hewitt, C. G. Add. 1913.1.

Eel feeding on mouse. Banister, J. D. 1843.1. — *on pufferfish.* Putnam, F. W. 1872.3; — *on eggs of Limulus.* Warwell, H. C. 1897.1. — *on vole.* Anon. 434.

Cod feeding on whelks. Elmhirst, R. 1909.1. — *on squid.* Osborn, H. L. 1881.1. — *on whittings.* Trachmann, C. O. Add. 1889.1.

Different kinds of molluscs in stomach contents of haddock. Clapp, W. F. 1912.1.

A Holothurian (Synapta) in stomach of flat-fish. Peach, C. W. 1867.2.

Shad feeding on shrimp. Huyler, A. J. 1876.1.

Bream eating butterflies. Distant, W. L. Add. 1914.1.

An excellent paper. "The food of certain minnows" by ★C. M. Breder, Jr. & D. R. Crawford has recently appeared in *Zoologica: Sci. Contris.* N. Y. Zool. Soc. 1922, vol. 2, no. 14, pp. 287–327. figs.

For fishes feeding on mosquito larvæ, see Malaria, under Diseases of man.

Plankton as food, i. e., the role of the minute surface forms of animal and plant

life such as protozoa, entomostraca, etc., in the alimentation of fishes.

Food, mainly planktonic, of fresh-water fishes. Arnold, J. P. 1902.2; Baird, W. 1857.1; ★Forbes, S. A. 1880.1, 3, 1883.2, 1888.1, 2, Add. 1914.1; Guerne, J. 1896.1; Leidy, J. 1881.1; Saunders, J. T. 1913.1; Smith, S. I. 1874.2; Steuer, A. 1901.1; ★Zacharias, E. O. 1892.1, 1893.4–1896.1, 1898.2, 1901.1, 1902.1, 3, 1909.1.

Diatoms eaten by fishes. Curtis, G. H. 1901.1, 2; Tokuhisa, M. 1908.1; Zacharias, E. O. 1902.2.

For the utilization of the natural plankton as food for cultivated young pond fishes, by making conditions favorable for its increase, see Natural food under Pisciculture.

Plankton (chiefly), as the source of food of marine fishes. ★Brooks, W. K. 1893.3; Day, F. 1882.5; Franke, J. 1906.1; Fulton, T. W. 1889.1; Hofer, B. 1896.1; McIntosh, W. C. 1887.2; Möbius, K. A. 1881.1, 1882.1; ★Peck, J. I. 1896.1; Ryder, J. A. 1882.10, Add. 1884.2; Sauvage, H. E. 1888.5; Steuer, A. 1905.1, 2; Sicard, A. 1877.1; Verrill, A. E. 1871.2; ★Wright, R. R. 1907.1; Dunn, M. Add. 1885.1.

Fresh-water plankton in the stomach of a Peruvian Characin, Lebiasina. Ehrenberg, C. G. 1848.1.

FOOD OF VARIOUS FISHES**Food of Ganoids**

Food of the dogfish, Amia calva. Dean, B. 1899.4.

The natural food of the young gar-pike (Lepidosteus) consists of mosquito larvæ. Mark, E. L. 1890.1.

Food of the sturgeon, Acipenser. ★Behning, A. L. 1912.1; Prince, E. E. 1899.1; Tenney, S. 1877.1; Tichij, M. 1912.2.

Food of Plagiostomes

Basking shark (Cetorhinus) and whale shark (Rhineodon) feed on plankton sifted by their branchial appendages. — *Cetorhinus.* Baird, S. F. 1873.13; Day, F. 1885.1; Pengelly, W. 1891.1; Hadfield, H. Add. 1885.1. — *Rhineodon.* Gudger, E. W. 1915.1; Kampen, P. N. 1908.1.

Eagle-ray (Ætobatis) crushes shells of clams with its teeth. Coles, R. J. 1910.1; Gudger, E. W. 1914.1.

Spines of fifty sting-rays, which it had eaten, removed from throat of a hammerhead shark. Gudger, E. W. 1907.1.

Food of Mustelus. Atwood, N. E. 1864.3. *Skate feeding on lobster.* Halkett, A. 1910.1. — *on sand-eels, whelks, and cuttlefish.* Wilcocks, J. C. Add. 1886.1.

Food of Chimæra. Scott, T. 1911.2.

For human remains in stomachs of man-eating sharks, see under Predatory fishes.

Food of Teleosts**Sub-order Acanthopterygii**

Food of Cyclopterus. Apstein, C. 1910.1. — *Halibut.* Bean, B. A. 1889.9; ★Scott, T. (1000 stomachs examined) 1911.2. —

Mackerel. ★Bullen, G. E. 1908.1; Dunn, M. 1885.1, 1893.1; Kishinouye, K. 1895.1. — *Etheostominae*. Forbes, S. A. 1880.2. — *Lucioperca*. Gruber, A. 1893.1; Nehring, A. 1904.3. — *Echeneis*. Harting, P. 1871.1. — *Bass, small-mouth black*. Worth, S. G. Add. 1911.1. — *Sole*. Collinson, P. Pre-Linn. 1746.1.

Sub-order Anacanthini

Food of the cod. Clark-Kennedy, A. 1866.1; Cornish, T. 1885.3; Laughrin, W. 1862.1; Nordgaard, O. 1901.1; Saxby, H. L. 1865.1; Sharp, B. 1901.1; Brook, G. Add. 1886.1, 1887.1.

Food of Haddock. Brook, G. 1885.6. — *Whiting*. Gosden, F. 1880.1. — *Gadidae*. Kendall, W. C. 1898.1. — *Phycis*. Scott, T. 1911.2. — *Lota*. Gottberg, G. Add. 1912.1.

Food of the ling (Molva). Laughrin, W. 1862.1; Saxby, H. L. 1865.1; Wheeler, R. F. 1867.1.

Sub-order Apodes

Food of Eel. Archibald, Ch. F. 1899.1; Hintze, A. 1899.1; Schreitmüller, W. 1912.1; Trybom, F. 1899.1; Zacharias, E. O. (*Larval eels*) 1905.5.

Sub-order Malacopterygii

Food of the herring (Clupea harengus). Baird, S. F. 1871.18; Calderwood, W. L. & Brook, G. 1885.1; Day, F. 1882.6; Dunn, M. 1885.1; Möbius, K. A. 1873.2, 1878.3, 4; ★Nordgaard, O. 1907.1; Pearcey, F. G. 1884.1; ★Scott, T. 1907.1; Sim, G. 1883.2; Stark, John. 1840.1; Toni, G. B. 1908.1; Calderwood, W. L. Add. 1895.1; Hadfield, H. Add. 1885.1.

Food of Sardine (immature Pilchard). Cépède, C. 1907.3, 4, 1910.1, 2, 3; Pouchet G. & Guerne, J. 1887.1; Roché, G. 1893.3; Sauvage, H. E. 1886.1; Guerne, J. Add. 1887.1.

Food of Pilchard. Dunn, M. 1885.1; ★Swithinbank, H. & Bullen, G. E. Add. 1913.1.

Food of Shad. Baird, S. F. 1874.8; Barbieri, C. 1908.1; ★Barfurth, D. 1874.1, 1876.1; Dröscher, W. 1898.1; Leidy, J. 1862.1, 1868.3; Mordecai, E. R. 1882.1; Weber, M. C. 1876.1.

Food of Coregonus (Vendace or Whitefish). Baird, W. 1857.1; Forbes, S. A. 1882.2, 3, 4, 1883.1, Add. 1882.1; Lebedintsev, A. A. 1908.3; Stark, John. 1837.1, 1840.1.

Menhaden. Peck, J. I. 1894.1.

Anchovy. Weber, M. C. 1886.3.

Sub-order Ostariophysii

Food of the carp. Cronheim, W. 1911.1; Fritsch, A. J. & Vávra, V. 1894.1; Gurney, J. H. 1860.1; Knauthe, K. 1896.4, 1899.2; McGovern, H. D. 1882.1, 1883.1; Nawratil, J. 1880.1; ★Supino, F. 1911.1, 2; Anon. 371.

For papers on the food of salmon and trout, the question of feeding in fresh-water, etc., see under Salmonidae.

FOOD OF FISHES OF VARIOUS LOCALITIES

Food of fishes of — Caspian Sea. Nikishin, V. G. 1909.1. — *Arctic seas*. Stappers, L. 1910.1. — *Ceylon seas*. Southwell, T. Add. 1913.2.

Europe. *Food of fishes of North and Irish seas around the British Isles*. Carr, A. M. 1909.2; ★Johnstone, J. 1906.1; Ray, R. 1914.1; Scott, A. 1896.1, 1907.2; ★Scott, T. 1902.2, 1903.1, 1911.2; ★Smith, W. R. 1891.1, 1892.1; ★Todd, R. A. 1903.1, 2.

Food of North European fishes, chiefly of Baltic Sea and of Germany. Dröscher, W. 1907.2; ★Levander, K. M. 1899.1, 1901.3, 1909.1; Möbius, K. A. 1875.2; Pancritius, P. 1887.1; ★Rauschenplat, E. 1901.1; Schiemenz, P. 1905.2, 4, 6; ★Schultz, G. 1911.1; Olsson, P. Add. 1872.1; Schorler, B., Thallwitz, J. & Schiller, K. Add. 1906.1.

Various papers on the food of the fishes of — Spain. Camps y de Olzinellas, C. 1906.1. — *France*. Gouriet, P. 1894.2; Arnoux, E. Add. 1889.2. — *Italy*. Guccini, L. 1904.1. — *Volga River, Russia*. Lavrov, S. 1909.1. — *Switzerland*. Schoch, G. 1890.4.

United States. *Food of fresh-water fishes of — Mississippi valley*. ★Forbes, S. A. 1878.5, 1889.1, Add. 1888.1. — *Michigan*. Hankinson, T. L. 1908.1. — *Kern River, Cal. (trouts)*. Juday, C. 1906.1. — *Twin Lakes, Colo.* Juday, C. 1907.2. — *Wisconsin*. Marshall, W. & Gilbert, N. C. 1905.1; ★Pearse, A. S. 1915.1. — *Nebraska*. Ward, H. B. 1898.1. — *Lakes of the Sierras*. Ward, H. B. 1903.1.

FOREIGN BODIES (EMBEDDED IN THE TISSUES OF FISHES)

Numerous instances are on record of pipefishes, sand-eels, the remains of crabs, skeletons of fishes, hooks, knives and other foreign objects found embedded in the liver, mesenteric folds, and muscles of fishes.

Various records. Atwood, N. E. 1868.1; Barrett, W. H. 1885.1; Williamson, H. C. 1911.2.

For an article containing reprints of all original records (20 in all), see E. W. Gudger in Natural History (Journ. Amer. Mus.) 1922, vol. 22, 452-457. 6 figs.

FORM OF FISHES

See also Adaptations.

Works of a general nature on form and hydrostatic stability. Houssay, F. 1900.1, 1912.2.

Proposed terminology for the various body shapes or forms of fishes. Gill, T. N. 1885.1.

Displacements and area-curves of fish. Parsons, H. B. 1888.1.

Palaeozoic fishes of anguilliform, compressiform, macruriform, depressiform and fusiform types. Abel, O. 1905.1, 1907.1.

Sagittiform adaptation of nectonic fishes. Schlesinger, G. 1909.1.

Form — Cont'd.

Embryological development of the external form or symmetry, causes, mechanical considerations, etc. His, W. 1894.3; Kopsch, F. 1898.1, 1898.3; Leuckart, C. G. 1850.1; Masterman, A. T. 1899.1; Rauber, A. 1879.1; Ryder, J. A. 1879.1; ★Keibel, F. Add. 1902.1.

For the development of the asymmetry of flat-fishes, see under Pleuronectidæ.

Miscellaneous papers on the form or shape of fishes. Dean, B. 1895.4; Houssay, F. 1905.1–1912.2, Add. 1911.1, 1914.1; Knauer, F. K. 1880.1; Mazza, F. 1893.1; Nikolskii, A. M. 1891.1; Osburn, R. C. 1913.3; Tenney, S. 1877.2; Walter, E. 1911.1; Thilo, O. Add. 1898.1.

GASTROLITHS (STOMACH STONES)

For chemical concretions in the alimentary tract, see Calculi under Pathology.

Stones or pebbles (enteroliths) found in the stomachs of cod, pike, turbot, etc., presumably aiding in the trituration of food. Baird, S. F. 1872.24; Bree, W. T. 1830.1; Decker, W. 1896.1; Hoernes, R. 1904.1; Moodie, R. L. 1912.1; Wickes, W. H. 1908.1.

Possibility that pebbles in certain geological formations have been transported by fishes. Vaillant, L. L. 1892.4.

GENERAL WORKS ON NATURAL HISTORY

Comprising Compendia, Dictionaries, Encyclopedias, Manuals, Text-books, etc., with especial reference to the natural history of fishes.

For works of a general or comprehensive nature relating specifically to definite organs, systems, genera or higher groups, see under the specific headings, such as Anatomy, Angling, Embryology, Fisheries, Physiology, and other such major groupings.

For a list of catalogues of works on natural history, see Part IV of this work on "General Bibliographies."

For the history and development of the natural sciences, see Historical matter.

For general works of a precise nature relating to the science of ichthyology, see Ichthyology.

DICTIONARIES AND LEXICONS

Chiefly "Handwörterbücher der Zoologie." Brüning, C. 1911.4; ★Frenzel, J. 1897.1; Jourdan, A. J. 1834.1; Knauer, F. K. 1887.1; Nemnich, P. A. 1793.1; ★Ziegler, H. E. 1909.1; Baikie, E. S. Add. 1878.1.

GENERAL NATURAL HISTORIES**Important Treatises**

Text in Dutch. Burgersdijk, L. A. 1862.1; Houttuyn, M. 1761.1; Vrolik, W. 1854.1.

Text in English. Brookes, R. 1763.1, 1773.1, 1790.1; Buffon, G. L. 1831.1, 1860.1; Cuvier, G. L. 1834.1, 2, 1840.1; Goode, G. B. & others 1887.1; ★Harmer, S. F. 1904.1; Hill, J. 1771.1; Kingsley, J. S. 1885.1; Lamarck, J. B. 1914.1; ★Lankester, E. R. 1900.1; Lydekker, R.

1894.1, 1903.1; Lydekker, R., Johnston, H. & others 1910.1; Pycraft, W. 1910.1; Shaw, G. 1800.1; Shaw, G. & Nodder, F. P. 1790.1; Swainson, W. 1820.1, 1838.1; Turton, W. 1802.1; Fleming, J. Add. 1822.1.

Text in French. Beaurieu, G. G. 1770.1; Beudant, F. S., Edwards, H. M. & Jussieu, A. L. 1867.1; Bomare, J. C. 1764.1; Bory de Saint-Vincent, J. B. 1822.1; Buc'Hoz, P. J. 1771.2; Buffon, G. L. 1798.1–1834.1; Chenu, J. C. 1874.1; Chevrolat, L. A. 1839.1; Cuvier, G. F. 1804.1; Cuvier, G. L. 1817.1, 1829.1, 1836.1, 1844.1; Knorr, G. W. 1766.1; Lacépède, B. G. 1844.1; La Chenaye-Desbois, F. A. 1759.1; Lamarck, J. B. 1809.1; Orbigny, A. C. 1839.1; ★Perrier, J. O. E. 1903.1; Sonnini de Manoncourt, C. N. 1799.1; Valmont de Bomare, J. C. 1765.1; Virey, J. J. 1835.1; Anon. 662.

Text in German. Borowski, G. H. 1784.1; Brehm, A. E. 1863.1, 1876.1, 1892.1, 1914.1; Bronn, H. G. 1859.1, 1874.1; Cuvier, G. L. 1831.1, 1846.1; Kaup, J. J. 1835.1; Lenz, H. O. 1838.1–1878.1; Leunis, J. 1844.1–1883.1; Martin, P. L. 1876.1; Martini, F. H. 1774.1; Oken, L. 1816.1, 1833.1; Suckow, G. A. 1797.1; Voigt, F. S. Add. 1831.1.

Text in Spanish. Brehm, A. E. 1882.1; Chao, E. 1852.1.

Lesser Works on Natural History

Text in English. Baird, S. F. 1852.1; Brown, T. 1832.1; Cuvier, G. F. 1840.1; Donovan, E. 1823.1; Duncan, F. M. 1913.1; Edwards, G. 1758.1; Goldsmith, O. 1774.1–1858.1; Holloway, W. & Branch, J. 1804.1; Jenyns, L. 1846.1; Jordan, D. S. 1876.2–1899.2; Jordan, D. S. & Van Vleck, B. H. 1874.1; ★Lydekker, R. 1912.1; Lydekker, R. & others 1897.1; Mayo, B. 1818.1; Pluche, N. A. 1785.1; Shufeldt, R. W. 1897.3; Smith, T. 1806.1; Stark, John 1828.1; Wood, J. G. 1861.1; Wood, William 1807.1; Anon. 187, 345, 374; Forbes, E. Add. 1859.1; Ruschenberger, W. S. Add. 1856.1; Strong, A. B. Add. 1851.1.

Text in French. Alléon, D. 1765.1; Bertrand, J. E. 1779.1; Boitard, M. P. 1827.1; Cuvier, G. L. 1798.1; Pluche, N. A. 1763.1; Rafinesque-Schmaltz, C. 1815.1; Raymond, G. M. 1828.1; Virey, J. J. 1822.1.

Text in German. Bertuch, F. J. 1806.1; Hesse, R. & Doflein, F. 1910.1; Müller, J. T. 1780.1; Ramisch, F. H. 1835.1; Strack, —. 1819.1; Vogt, C. C. 1851.1; Wiedemann, C. R. 1800.1; Wilhelm, G. T. 1817.1; Wilmsem, F. P. 1831.1; Anon. 390.

Pre-Linnæan Works

Including natural histories, encyclopædias and early general works containing references to fishes.

Most of these works appeared in several editions and in various languages. Ad-Damiri, I. K. 1372.1; Andrew, L. 1510.1;

★Aristotle, 1476.1; Bartholomæus Anglicus, 1470.1; Birckerodius, T. B. 1694.1; Brisson, M. J. 1754.1; Burton, R. 1678.1; Candidus, D. P. 1460.1; Cerutus, B. 1622.1; Coetlegon, D. 1745.1, 1746.1; Cube, J. 1485.1; Cupani, F. 1713.1; Edwards, G. 1743.1; Franciscus, E. 1668.1; ★Gesner, C. 1558.1, 1575.1, 1619.1; Gilles, P. 1535.1; Hill, J. 1748.1; Hildegard de Pinguia 1533.1; Hövel, H. 1601.1; Johnson, T. 1595.1; ★Jonston, J. 1632.1; Konrad of Megenburg, 1475.1; Knorr, G. W. 1754.1; Kräutermann, V. 1730.1; Lonicer, A. 1551.1; Marsigli, L. F. 1725.1; Martyn, B. 1735.1; Münster, S. 1543.1; Muralt, J. 1709.1, 2; Neckham, A. 1180.1; Nieremberg, J. E. 1635.1; Nylant, P. & Hextor, J. 1678.1; Petiver, J. 1702.1; ★Pliny, C. 1469.1; Pluche, N. 1732.1; Raimondi, E. 1610.1; Reisch, G. 1496.1; Schnurr, B. 1654.1; Szent-Iványi, M. 1689.1; Vincent, L. 1715.1; Vincentius Bellovacensis 1473.1; Watson, F. 1754.1; ★Worm, O. 1655.1; Zanardus, M. 1619.1; Anon. 731, 732, 733, 754, 755, 774.

POPULAR WORKS

Including anecdotes, marvels of fish life, narratives, tales of the sea, etc.

For legends and fables of fish life, see Mythology and symbolism.

Text in Dutch. Brussel, T. 1798.1; Hauwaert, P. 1901.1, 1901.2; Redeke, H. C. 1911.2; Richter, J. G. 1768.1, 1780.1; Anon. 319.

Text in English. Abbott, C. C. 1888.1; Adams, A., Baikie, W. B. & Barron, C. 1854.1; Adams, W. H. 1870.1; Agassiz, J. L. 1847.1; Arnold, A. & Samuel, E. A. 1868.1; Beavan, A. H. 1905.1, 1908.1; Bigland, J. 1828.1–1865.1; Boyd, J. P. 1888.1; Brown, T. 1835.1; Buckland, F. T. 1857.1, 1875.1, 1876.1, 1882.1; Bullen, F. T. 1899.1–1904.2; Bushnan, J. S. 1840.1; Clarke, S. C. 1892.1; Damon, W. E. 1877.1, 1888.1; Duncan, F. M. 1913.2, 3; Duncan, F. M. & Duncan, L. T. 1913.1; Elmhirst, R. 1913.2; Emerton, J. H. 1880.1; Esdaile, D. 1865.1; Furneaux, W. 1896.1; Gosse, P. H. 1849.1–1854.1; Hamilton, E. 1890.1; Harper, J. 1858.1; ★Holder, C. F. 1903.1, 1906.1, 1908.1, 1910.1, 3, 1913.1, Add. 1885.1–1912.1; ★Holder, C. F. & Jordan, D. S. 1909.1; Jesse, E. 1832.1; McCarthy, E. 1900.1; Morris, F. O. 1860.1; Northrop, H. D. 1901.1; Ogilvie, G. 1858.1; Petersen, C. G. 1900.1; Prouty, L. 1883.1; ★Pycraft, W. 1901.1; Reynolds, S. 1911.1; Simeon, C. 1860.1, 1863.1; Thompson, J. A. 1914.1; Trimmer, M. 1830.1; Walcott, J. 1788.1; Walcott, S. 1795.1; Wood, J. G. 1857.1; Wraxall, F. C. 1860.1; Baskett, J. N. Add. 1899.1; Boulenger, G. A. & Boulenger, C. L. Add. 1914.1; Cowan, F. Add. 1894.1; Davies, E. W. Add. 1887.1; Figuier, L. Add. 1869.1; Giberne, A. Add. 1902.1; Perry, W. A., Mosher, A. A. & others. Add. 1892.1.

Text in French. Blocquel, S. 1826.1; Buc'Hoz, P. J. 1769.1; Chailland, —. 1769.1; Dralet, —. 1821.1; Figuier, G. L. 1868.1, 1876.1; Haüy, R. J. 1787.1; Jannettaz, P. M. 1869.1; Moquin-Tandon, C. H. 1865.1, 1866.1; Oudart, P. L. 1825.1; Pérez, C. C. 1901.1; Ray, P. A. 1788.1, 1804.1.

Text in German. Buhle, C. A. 1812.1; Hartwig, G. L. 1857.1; ★Hentschel, E. 1909.1; Krüger, J. G. 1759.1; Leonhardt, E. E. 1913.1; Leuckart, F. S. 1832.1; Marshall, W. A. 1898.1; ★Plehn, M. 1906.2; Rauther, M. 1907.2, 3; Schreiber, —. 1913.1; Anon. 633; Giebel, C. G. Add. 1860.1.

Text in Italian. Bianconi, C. G. 1848.1; Giglioli, E. H. & Issel, R. 1884.1; Doni di Nettuno. ★Cavanno, G. Add. 1914.1.

Text in various languages. — *Swedish.* Aulin, H. 1760.1. — *Danish.* Fleischer, E. 1795.1. — *Russian.* Nikolskiĭ, A. M. 1902.1. — *Spanish.* Philippi, R. A. 1864.1. — *Latin.* Scopoli, G. A. 1787.1. — *Japanese.* Anon. 529.

ZOOLOGIES

Comprising Handbooks, Manuals, Textbooks, etc.

Text in Danish. Boas, J. E. 1888.1.

Text in Dutch. Harting, P. 1862.3; Hoeven, J. 1849.1.

Text in English. Baird, S. F. 1851.1; Boas, J. E. 1896.1; Hertwig, C. W. 1913.1; Hoeven, J. 1856.1; ★Kingsley, J. S. 1900.1; Lankester, E. R. 1889.2, 3, 1911.2; Marshall, A. M. & Hurst, C. H. 1887.1; Morgan, C. L. 1887.1; Nicholson, H. A. 1870.1, 1871.1; Packard, A. S. Jr. 1880.1; ★Parker, T. J. & Haswell, W. A. 1897.1; ★Sedgwick, A. 1885.1, 1898.1; Shipley, A. E. & Macbride, E. W. 1901.1; Thomson, J. A. 1892.1, 1910.1; Wells, H. 1894.1; Wells, H. G. & Davies, A. M. 1913.1; Weyser, A. W. 1904.1; Parker, T. J. & Parker, W. N. Add. 1900.1.

Text in French. ★Delage, M. Y. & Hérouard, E. 1898.1; Edwards, H. M. 1835.1; Pouchet, F. A. 1832.1, 1841.1.

Text in German. Boas, J. E. 1894.1; Brandt, A. T. 1911.1; Brühl, C. B. 1877.1; Carus, J. V. & Gerstaecker, C. E. 1863.1; Goette, A. 1902.1; Goldfuss, G. A. 1820.1; ★Hertwig, C. W. 1891.1, 1910.1; Hertwig, W. A. 1906.1; Hilzheimer, M. & Haempel, O. 1913.1; Hufeland, —. 1798.1; Kner, R. 1849.1; Kuhl, H. 1820.1; Nussbaum, J., Karsten, G. & Weber, M. 1911.1; Pagenstecher, H. A. 1875.1; Thienemann, F. A. 1828.1; Treviranus, G. R. 1802.1; Voigt, F. S. 1835.1.

Text in Italian. Bassani, F. 1885.1; Doria, G., Ferrari, S. M. & Lessona, M. 1861.1–1869.1; Ranzani, C. 1819.1.

Medical Zoologies. Brandt, J. F. & Ratzeburg, J. T. 1829.1; Czenpinski, P. 1778.1; Szirmay, A. I. Add. 1840.1.

GROWTH, AGE, AND SIZE

References to the development and growth of individual forms will be found under the various families and genera, under the heading Natural History.

Papers relating to metamorphosis and growth will be found under such families as Anguillidæ, Pleuronectidæ, and Salmonidæ.

For related subjects, see under such topics as Embryology, Form, etc.

For the relations between age and reproduction, see Sexual maturity under Reproduction.

Mode of growth. Henneguy, L. F. 1887.1; Packard, A. S. Jr., 1875.1. — *Distribution of form-building capacities in animal bodies.* Przibram, H. 1910.1. — *Lengthening process.* His, W. Add. 1891.1.

Relation of weight to length in Mustelus. Hecht, S. 1913.1.

Relative growth of organs and parts, Mustelus. Kearney, H. L. Add. 1914.1.

Relative dimensions of adults and young of Alopias vulpes. Vaillant, L. L. 1886.2.

Correlations of weight and length in the weakfish, Cynoscion regalis. Crozier, W. J. & Hecht, S. Add. 1914.1.

Miscellaneous and unimportant papers, notices, popular accounts, etc., on age and growth in fishes, age-determination from the point of view of the fish-culturist, etc.

Text in — English. Afalo, F. G. 1902.4; Baird, S. F. 1876.21; Meek, S. E. 1900.3. — *Norwegian.* Dahl, K. 1911.2, 1912.1; Dahl, K., Damas, D. & Sund, O. 1909.1; Grieg, J. A. 1908.1; Nordgaard, O. 1901.1. — *Russian.* Emeljanenko, P. E. 1909.1; Grimm, O. 1901.2, 3, 1904.2; Heide, E. J. 1912.1; Ostroumov, A. A. 1910.1–1913.1. — *Finnish.* Ericsson, B. 1905.1. — *Swedish.* Hederström, H. 1759.1; Mäklin, F. W. 1864.1, 1865.1; Nordqvist, O. F. 1907.2, 1909.2; Petersen, C. G. 1892.1. — *Dutch.* Hoek, P. P. 1912.3; Tesch, J. J. 1910.1, 1913.1. — *Italian.* Mazzarelli, G. F. 1904.1; Supino, F. 1910.1. — *Danish.* Otterstrøm, A. N. 1906.1. — *Japanese.* Watanabe, M. 1913.1.

Text in German. Apstein, C. 1900.1, 1909.1; Bartels, F. 1910.2; Braun, M. G. 1893.1; Cronheim, W. 1908.1; Lücke, Fr. 1911.1; Milewski, A. 1912.4; Popta, C. M. 1907.2; Reeker, H. 1909.1; Reuss, H. 1908.1, 2; Stieda, L. 1871.2.

METHODS IN DETERMINATION of age and growth

For a short historical résumé in English of the development in Europe of all the methods in the determination of growth and age, with the chief literature, see ★Dahl, K. 1909.1.

Older methods

Professor Sars attempted to begin with the newly hatched fry of the cod, measuring their growth and observing it year after year. Sars, G. O. 1865.1 et seq.

Similar observations on herring were made by Meyer, H. A. 1878.1, 2.

RATE OF GROWTH

A great stimulus to studies on age and growth was given by the work of Petersen. His method consisted chiefly in the mensuration of large numbers of immature fishes of all sizes to determine the limits of the various series or generations — the median point (or average) between the extreme limits of the series being taken as the mean of a "group-series" or annual "size-unit" or "year-class." By a study of these group-series, it was expected to determine the full growth-rate of a given species. Experience, however, has shown that, as a rule, only the first 2-3 year classes are recognizable.

Original statement of this method. Petersen, C. G. 1891.2, 1895.2.

Following this method, with slight modifications, observations chiefly on the rate of growth have been made as follows. — *Flounder, plaice, dab, sole, turbot, whiting, poor cod, and pilchard.* Cunningham, J. T. 1891.9, 11, 1892.2, 3. — *Plaice.* Dannevig H. C. 1899.1; Johnstone, J. 1908.2, 1910.4, 1912.4, Add. 1912.1, 1914.2; Kyle, H. M. 1905.2, 1907.1. — *Gurnard.* Fulton T. W. 1899.1. — *Cod, haddock, whiting and Norway pout.* Fulton, T. W. 1901.3. — *Plaice, dab, whiting and haddock.* ★Fulton, T. W. 1902.3, 1904.5. — *Herring.* Masterman, A. T. 1895.3. — *Cyclopterus, Cottus, Agonus and Liparis.* Tosh, J. R. 1894.1.

Unclassified. Fulton, T. W. 1893.2; Williamson, H. C. 1893.1. — *Description of a fish-measuring board.* Riddell, W. 1914.1, 1915.1.

Recent methods in age determination

In 1899 Reibisch showed that the otoliths of plaice exhibit a periodic growth corresponding to summer and winter and are thus available for age determination. Reibisch, J. 1899.1.

About the same time, Hoffbauer demonstrated that the annual rings in the scales of the carp provided an indication of the age. Hoffbauer, C. 1898.1 et seq.

Since then numerous parts have proven available. "The choice of the organ for age determination may now be considered as being a question of an entirely practical kind, a question to be answered for each species. We employ the organ which most easily and cheaply can be procured. Some investigators have used the otoliths. Others have employed certain bones, as gill-covers, scapulæ, vertebræ, or neural processes. Others again have preferred to use the scales." Dahl.

A comprehensive dissertation in German on otolith structure with regard to age determination is ★Fryd, C. 1901.1.

For a comprehensive treatise in English on age determination as based on scale studies, see ★Taylor, H. F. 1916.1.

For an excellent popular paper on the relation of scale structure to growth in the Atlantic salmon, the meaning of the "spawning mark" on the scales, etc., see ★Hutton, J. A. Add. 1909.1.

ANGUILLA (Common eel)

As early as 1873, Baudelot suggested that the concentric zones in the scales of the common eel corresponded to periods of growth. Baudelot, E. 1873.4.

Other papers relating to the structure of the scales in regard to the determination of age in the eel. Ehrenbaum, E. & Marukawa, H. 1913.1; Gemzöe, K. J. 1907.1; Schneider, G. 1909.8; Haempel, O. Add. 1914.2.

CLUPEIDÆ

"Vertebrae as well as otoliths, also opercula and other flat bones are good, but none of these give so sure results as the scales." Dahl.

Otoliths used in analysis of age of herring. ★Jenkins, J. T. 1902.1. — Both scales and otoliths used comparatively. Broch, H. 1907.1–1908.2.

Various papers on the determination of age and growth, chiefly by the study of the scales, in the herring (*Clupea harengus*) with a few on the sprat (*C. sprattus*). Bounhiol, J. P. 1912.1; ★Dahl, K. 1907.2, 1909.3; Fulton, T. W. 1906.1; Schneider, G. 1908.2, 1909.9; Storrow, B. 1914.1, 1915.1; Sund, O. 1909.1; Thompson, D. W. 1911.2, 1914.3; Delsman, H. C. Add. 1914.1, 2; Hensen, V. Add. 1914.1. — Caspian herring (*Clupeonella*). Nedozhivin, A. & Tichij, M. 1913.1.

The Norwegian investigators have greatly developed the application of "scale readings" based chiefly on the herring. They believe the scale studies indicate not only the age but the size at different years and the conditions of existence during those years. For the methods employed, see Lea, E. 1911.1, 1913.1. For a discussion of these methods, noting "the phenomenon of apparent change in growth rate," see Lee, R. M. 1912.2, Add. 1913.1.

For an elaborate monograph summarizing all the data on scale reading in the herring, see Molander, —. in Ur. Svenska Hydrographisk-Biologiska Kommissions Skrifter for 1917.

GADIDÆ

"The scales as a rule are far superior to any other organ taken from the osseous system."

The following papers on growth and age determination relate chiefly to the cod (*Gadus morrhua*) and the pollack (*G. pollachius*). Carr, A. M. 1909.1; Cunningham, J. T. 1905.1; Dahl, K. 1906.4; ★Damas, D. 1909.1; Hjort, J. 1908.2; Lee, R. M. (Haddock) 1912.2; Maier, H. N. 1906.1; Redeke, H. C. 1909.1; ★Thomson, J. S. 1902.1, 1904.1, 1904.2; Winge, O. 1915.1.

Contrary to the almost universal opinion that the scales of fishes increase in size by annual growth rings, Brown (Alfred W. 1903.1) believes that in the cod, haddock, and whiting, the scales are annually shed after spawning until the age-limit of spawning is reached when no further shedding takes place.

PLEURONECTIDÆ

Among flatfishes, the plaice (*Pleuronectes platessa*) has been the chief subject of study. The structure of the otoliths, at least in younger fishes, provides a reliable index of age.

"As regards older fish the otoliths become too little transparent and the annual rings too close for an absolutely safe reading. In these cases the broad flat bones of the head and shoulder girdle are good subjects and give safer results." Dahl.

Otoliths first studied as indicators of age and growth. Reibisch, J. 1899.1.

Other papers on age and growth in plaice based on study of otoliths, bones, etc. Atkinson, G. T. 1908.1; Carr, A. M. (Dab) 1909.1; Cunningham, J. T. 1905.1; ★Heincke, F. 1906.1; Heincke, F. & Henking, H. 1908.1; ★Immermann, F. 1908.1; Johansen, A. C. 1905.1 (i), 1909.1, 1910.1, 1912.1; McMurrich, J. P. 1914.1; Maier, H. N. 1906.1; Meek, A. 1903.1, 1905.1; Petersen, C. G. 1903.1; ★Wallace, W. 1905.1–1911.1.

VARIOUS FISHES

Papers on the determination of age and growth by recent methods have appeared as follows. — *Salmo hucho*. Haempel, O. 1910.1; Salomon, K. 1908.1. — *Smelt* (*Osmerus*). Masterman, A. T. 1913.2. — *Mackerel* (*Scomber*). Nilsson, D. 1914.1. — *Anchovy* (*Engraulis*). Redeke, H. C. 1914.1. — *Coregonus albula*. Seligo, A. 1908.2. — *Cynoscion regalis* and *Orthopristis chrysopterus*. ★Taylor, H. F. 1916.1. *Carp*. Walter, E. 1901.1.

For additional references to scale studies on salmon, see below "Growth" under both Atlantic and Pacific salmon under Salmonidæ.

LONGEVITY

Age attained by fishes

Records of ages attained by fishes. In some cases, the records are of fishes kept in aquaria; in others known individuals have been under observation in the ponds of European monasteries or marked specimens are alleged to have been taken from the moats of feudal castles.

Such records are as follows. — *Carp* (375 yrs.). Baird, S. F. 1872.9; Mehwald, — 1873.1. — *Carp* (38 yrs.). Noll, F. C. 1879.2, 1882.1. — *Carp* (300 yrs.). Suffield, R. R. 1874.1.

Pike (267 yrs.). Baldinger, E. G. 1802.1. — *Loach* (260 yrs.). Bötticher, W. 1902.1. — *Goldfish* (30 yrs.). Essing, L. 1898.1. — *Trout* (19 yrs.). Harvie-Brown, J. 1898.1. — *Sea bass* (21 yrs.). Townsend, C. H. Add. 1913.5.

Miscellaneous items on longevity in — *Carp*. Falke, W. 1874.1. — *Pop. art.* in French. Oustalet, E. 1900.1. — *Trout*. Stone, L. 1872.5. — *Goldfish*. Riepe, E. Add. 1906.1.

SIZE ATTAINED

Popular article, "Some giant fishes of the sea." Smith, H. M. 1909.4.

Growth — Cont'd.

Largest and smallest of known fishes. Lönnberg, A. J. 1902.10; Henn, A. W. Add. 1912.1.

A minute goby (Mistichthys luzonensis) from the Philippines, of which egg-bearing, mature females only twelve mm. long have been taken, is the smallest known vertebrate. Smith, H. M. 1902.5, 8, 11, 13, 1903.3. *Figured in* 1902.8.

The whale shark (Rhineodon typus), of which specimens forty-five feet in length have been captured, is the largest recent fish. Gudger, E. W. 1915.1; Regan, C. T. Add. 1913.1.

Largest deep sea fish, Macrurus amissus, is five feet in length. Gill, T. N. & Townsend, C. H. 1901.1.

Miscellanea. — Environmental conditions determining size. Chudeau, R. 1898.1. *Dwarf races of Coregonus.* Klunzinger, C. B. 1900.1. — *Dwarfed forms among Swedish fishes.* Lönnberg, A. J. 1902.8. — *Dwarfed muskallonge.* Sterling, E. 1877.1. — *Relation of size to saline content of sea.* Anon. 497. — *Absolute and relative weights of viscera.* Bellingeri, C. F. Add. 1849.1. — *The maximum size of fishes and its causes.* Prince, E. E. Add. 1904.2.

RECORDS OF SIZE

Unquestionably numerous additional records of large size of fishes will be disclosed by search through the literature. The following references are for the most part those which indicate by their titles that they refer to large specimens.

Large specimens recorded as follows**ELASMOBRANCHII**

Carcharias. Bennett, G. 1859.1. — *Sphyrna (12.5 ft.).* Gudger, E. W. 1907.1; Welsh, W. W. 1916.1. — *Pristis (16 ft.).* Shields, S. A. 1879.1.

A weight of 4000 pounds for a specimen of Carcharodon carcharodon, taken in the Mediterranean, is given by Bonaparte, C. L. 1839.1.

Speculations on the probable length of the largest of all fishes, the shark Carcharodon megalodon, known only from fossil teeth. Bowerbank, J. S. 1852.1; Dean, B. 1909.1; Hussakof, L. 1912.2.

GANOIDEI

Polyodon. Hussakof, L. 1911.3.

Lepidosteus tristæchus. Shufeldt, R. W. 1903.9.

See also C. H. Townsend, "Giant Gars from Louisiana" in Bull. N. Y. Zool. Soc. 1920, vol. 23, pp. 119-120.

TELEOSTEI

Large specimens of the carp. Chion, — 1838.1; Garman, S. 1889.2; Grube, A. E. 1866.1; Häfeli, — 1802.1; Lavenier, — 1895.1; Mackrill, A. 1884.1.

Large specimens of the cod. Baird, S. F. 1872.18; Lönnberg, A. J. 1907.4; Smith, Everett, 1883.1.

Large specimens of the pike (Esox). Baird, S. F. 1872.1, 1875.21; Gurney, J. H. (46 in. long) 1875.1; Hintze, A. 1897.1; Jardine, A. Add. 1898.1. — *Probable weight*

of seventy-two lbs. for the giant pike of Loch Ken of Scotland. Regan, C. T. 1911.9.

Large specimens recorded as follows:

— *Epinephelus.* Alcock, A. W. 1905.1. — *Stereolepis.* Boulenger, G. A. 1897.9. — *Eel.* Cornish, T. 1872.4; Anon. 363 (36 lbs.). — *Halibut (Hippoglossus).* G., N. 1877.1. — *Thymallus.* Hintze, A. 1893.2. — *Gasterosteus (82 mm.).* Levander, K. M. 1900.2. — *Lota.* Nordqvist, O. F. 1904.4. — *Trout.* Pellegrin, J. 1900.9. — *Bluefish (Pomatomus).* Smith, H. M. 1903.1. — *Brook trout.* Sterling, E. 1875.1. — *Conger (53 lbs.).* Sweetapple, E. 1869.1. — *Bream (Abramis) (15 lbs.).* Zur Mühlen, M. 1911.2.

Large specimens of the "Mahaseer" (Barbus mosal), of mountain streams of India and Ceylon. Kinnear, N. B. 1910.1; Murray-Aynsley, C. E. 1910.1; Wallenger, W. A. 1908.1; Willey, A. 1903.1; Skene Dhu Add. 1906.1.

Records of large specimens of the ocean sunfish, Orthogoriscus mola. Mikhailovskii, M. M. 1903.1; Nardo, G. D. 1841.1; Stearns, R. E. 1867.1; Dean, B. Add. 1913.2.

A table comprising the ★ "World's record catches with rod and reel and otherwise of 50 North American popular fresh and salt water fishes" has been compiled recently by J. T. Nichols and Van Campen Heilner, and published in Field and Stream, July, 1920, pp. 268-269.

Smallest specimens on record

Of various fishes, whose developmental history is not known, the smallest known specimens have been recorded as follows: — *Polyodon.* Barbour, T. 1911.1; Danforth, C. H. 1911.1. — *Remora.* Daldorf, D. C. Add. 1793.1.

GUSTATORY ORGANS

For the functions of these organs, see Taste.

Anatomy in — Cyprinus. Beneden, P. J. 1835.1; Fohmann, V. 1835.2; Weber, E. H. 1827.7. — *Teleostei.* Jourdan, E. 1881.1. — *Elasmobranchii.* Nardo, G. D. 1846.2, 1851.1; Todaro, F. 1872.1, 1873.1, Add. 1873.1.

Miscellaneous and general. Duméril, A. M. 1858.1; Herrick, C. J. 1904.1; Schulze, F. E. 1868.1.

Taste buds. *Structure, origin, nerve terminations in, etc.* Dogiel, A. S. (Ganoidei) 1897.1; Johnston, J. B. 1909.2; Lenhossék, M. 1892.2.

Structure and distribution of taste buds in — Cottus. Maehrenthal, F. C. 1892.1. — *Petromyzon.* Retzius, M. G. 1893.4. — *In mouth, Lophius.* Guitel, F. 1891.2, 5. — *In skin of head and barbels of Ameiurus and hake.* Herrick, C. J. 1903.2; Landacre, F. L. 1907.1.

HABITS OF FISHES

For the breeding habits of fishes comprising courtship, spawning behavior, parental care, nest-building, oral gestation, viviparity, etc., see under Reproduction.

For the "intelligence" of fishes comprising their comparative psychology, and for technical studies on habit formation, etc., see under Behavior.

For the living together or association of fishes with other fishes, or with invertebrates, see under Commensalism and symbiosis.

For accounts of sharks attacking men, sword-fish attacking whales, etc., see under Predatory fishes.

See also under such related topics as Aestivation; Food of fishes; Hibernation; Locomotion; Migrations; Parasitic fishes; Sleep of fishes; etc.

References to the life-histories, etc., of particular fishes will be found under the various families and genera to which they refer.

Chiefly miscellaneous and unclassified items on the habits of fishes. Abel, O. 1907.1; Aflalo, F. G. 1902.2, 1904.2; Baird, S. F. 1876.8; Beckford, F. J. 1897.1; Beckmann, J. 1769.1; Blake, J. H. 1870.1; Blanchard, C. E. 1866.1; Carter, R. 1884.1; Coles, R. J. 1910.1; Coste, P. 1858.1; Dollo, L. 1895.1; Ehrenbaum, E. 1909.2; Gray, J. E. 1861.1; Groos, R. 1902.1; Huet, P. 1904.1; Nusbaum, J. 1880.1; Osburn, R. C. 1913.2; Selous, E. 1911.1; Shufeldt, R. W. 1902.2; Smith, T. 1806.1; Tosh, J. R. 1903.1; Verrill, A. E. 1871.2.

GENERAL ACCOUNTS OF THE HABITS OF VARIOUS FISHES

Comprising general and inclusive articles dealing with the unspecified habits of fishes.

CEPHALOCHORDATA

Habits of Amphioxus. Gage, S. H. 1905.1; Rice, H. J. 1880.1.

ELASMOBRANCHII

Habits of Mobula. Coles, R. J. 1910.1; Gill, T. N. 1908.5. — *Selachii.* Duméril, A. H. 1865.4. — *Scyllium.* Geoffroy-Saint-Hilaire, E. F. 1808.1. — *Rhineodon.* Gill, T. N. 1905.11.

DIPNOI AND GANOIDEI

Habits of Amia and Lepidosteus. Locke, W. M. 1878.2, 1879.4. — *Lepidosteus.* Mark, E. L. 1890.1. — *Ceratodus.* Macleay, W. 1883.5; Semon, R. W. 1896.2, 1899.1, 1903.1, 1908.1, Add. 1893.1, 2; Spencer, W. B. 1892.1, Add. 1892.1.

TELEOSTEI

Sub-order Acanthopterygii

Gobiiformes. — *Habits of Periophthalmus.* Bean, B. A. 1889.6; Livingstone, D. & Livingstone, C. Add. 1866.1; Woodford, C. Add. 1890.1. — *Sicydium.* Clark, Austin H. 1905.1. — *Cyclopterus.* Gill, T. N. 1907.3.

Jugulares. — *Habits of Batrachus.* Apun, K. F. 1870.1. — *Uranoscopus.* Facciola, L. 1883.1. — *Anarrichadidae.* Gill, T. N. 1911.2. — *Opsanus.* Gudger, E. W. 1910.1. — *Trachinus.* Dunn, M. Add. 1885.2.

Perciformes. — *Habits of Aphredoderus.* Abbott, C. C. 1862.2, 1872.2. — *Perca flavescens.* Abbott, C. C. 1876.1. — *Enneacanthus* and *Mesogonistius.*

Abbott, C. C. 1884.2. — *Labrax.* Akers, G. F. 1879.1. — *Mullus.* Couch, J. 1869.1. — *Centrarchidae.* Mather, F. 1884.4. — *Micropterus.* Tisdale, S. T. 1871.2. — *Ruvettus.* Becke, L. Add. 1897.1, 1909.1. — *Capros.* Cunningham, J. T. Add. 1888.1.

Scleroparei. — *Habits of Cottus.* Bade, E. 1899.4; Gill, T. N. 1908.2. — *Myoxocephalus.* Gill, T. N. 1905.15. — *Liparis.* Smith, W. A. Add. 1885.1.

Scombriformes. — *Habits of Scomber.* Allen, E. J. 1897.3; 1909.1; Cunningham, J. T. 1902.2. — *Lepidopus.* Robson, C. H. 1876.1, 1884.2.

Zeorhombi. — *Habits of Pleuronectes.* Ascroft, R. L. 1900.2; Bean, T. H. 1878.6. — *Hippoglossus.* Atwood, N. E. 1865.1, 1869.2, 1871.1.

Sub-order Apodes

Habits of Anguilla. Baird, S. F. 1875.16; Caumont, A. 1858.1; Dean, B. 1912.2; Desmarest, E. 1866.1; Friedel, E. 1871.3; McGovern, H. D. 1881.1; Olivier, E. 1910.1; Roosevelt, R. B. 1878.3, 4; Anon. 275.

Sub-order Haplomi

Habits of Umbra. Abbott, C. C. 1875.2. — *Esox.* Curtis, G. 1861.1. — *Anableps.* Le Conte, J. L. 1861.1; Smith, J. P. G. 1850.1; Beebe, M. B. & Beebe, C. W. Add. 1910.1.

Sub-order Malacopterygii

Habits of Thymallus. Ainsworth, S. H. 1874.1; Rutland, J. 1878.1. — *Pomatomus.* Ayres, W. O. 1852.1. — *Mallotus.* Atwood, N. E. 1871.1. — *Alosa.* Barfurth, D. 1874.1, 1876.1; Chapman, P. 1875.1. — *Herring.* Chapman, P. 1875.1. — *Pilchard.* Cornish, T. 1883.1. — *Osteoglossum.* Haseman, J. D. 1911.2. — *Coregonus.* Milner, J. W. 1877.1.

Sub-order Ostariophysii

Habits of Gymnotus. Bradley, T. 1838.1; ★Sachs, C. 1877.1, 1881.1. — *Phoxinus.* Bruyant, C. 1898.1. — *North American Siluridae.* ★Kendall, W. C. 1904.1, 1910.1. — *Tinca.* Lunel, G. 1874.2. — *Ameiurus.* Sainville, E. 1908.1. — *Carassius.* Stratton, H. Add. 1833.1.

Habits of Teleostean fishes of various other sub-orders

Hemiramphus. Andrews, W. 1849.3. — *Orthogoriscus.* Binney, A. 1842.1. — *Belone.* Cunningham, J. T. 1902.2. — *Syngnathus.* Gray, J. E. 1861.1. — *Merluccius.* Nye, W. jr. 1887.2. — *Antennarius.* Whitmee, S. J. 1875.1. — *Gadidae.* Atwood, N. E. 1866.1, 2.

For further data on habits of fishes, see under Natural History under the fish in the Systematic section.

VARIOUS SPECIFIC HABITS

For specific habits treated elsewhere, see cross-references at the beginning of this section.

Habits — Cont'd.**Burrowing habits**

Rissola marginata. Gill, T. N. 1905.9; Gudger, E. W. 1905.3. — *The "Bora Chung," Bootan, India*. Pearson, J. T. 1840.1; Campbell, A. Add. 1842.1. — *Zeugopterus*. Richardson, J. 1860.2. — *Astroscopus*. Dahlgren, U. Add. 1914.3.

See also in this connection the sections on Aestivation and on Hibernation.

Fighting habits of *Betta pugnax*

Boulenger, G. A. 1904.7; Cantor, T. E. 1849.1.

For a late account, see F. H. Stone in Journ. Bombay Nat. Hist. Soc., 1914, vol. 22, pp. 632-633.

Other accounts will probably be found under *Betta* in the section Aquarium Fishes.

Habits of Inflation

Tetrodon. Jackson, J. B. S. 1848.1; Sørensen, W. E. 1883.1. — *Diodon*. Pycraft, W. 1903.1.

For a general account (with illustrations) of this habit among *Gymnodontes*, see E. W. Gudger in Bull. N. Y. Zool. Soc. 1919, vol. 22, pp. 126-131.

Cephaloscyllium. Jordan, D. S. & Gilbert, C. H. 1880.36.

Water-throwing habits of the archer-fish, *Toxotes*

Brehm, A. E. 1883.1; ★Gill, T. N. 1909.2; Hommel, — 1777.1; Schlosser, J. A. 1764.1, 1777.1; ★Zolotniskii, N. F. 1902.1, 2; Beccari, O. Add. 1904.1; D'Argenville, A. J. Add. 1767.1; Jacobs, T. J. Add. 1884.1.

For additional accounts, see P. Nitsche "Der Schützenfische (*Toxotes jaculator*)" Natur u. Haus, 1899, vol. 8, 22-25; and Lampert, K. *Idem.*, 1899, vol. 8, 43-44.

Disbelief of alleged archer-feats; *Chelmon rostratus* considered true archer-fish. ★Day, F. 1881.4.

Similar water-throwing habit in other fishes. Townsend, C. H. Add. 1909.1.

HEAD

For the structure and relationships of the mouth, see Oral cavity under Alimentary Canal.

For the musculature of the head, see Cranial and visceral muscles under Myology.

For the external open sac of the olfactory organ, see Nares under Olfactory organs.

For the bony framework of the head, see Skull.

For an outstanding treatise on the morphology and development of the head, see ★Locy, W. A. 1895.1.

Embryology and development

General papers. ★Ayers, H. 1891.1; Froriep, A. 1902.2; His, W. 1894.2; ★Kupffer, C. W. 1893.3, 1896.1; Minot, C. S. 1897.1.

Development of the head in *Cyclostomata*. — *Petromyzon*. ★Koltzoff, N. K. 1902.1; Kupffer, C. W. 1893.1 (ii, iii) — *Bdellostoma*. Kupffer, C. W. 1899.2.

Development in *Selachii*. ★Froriep, A. 1901.1; Hoffman, C. K. 1894.1.

Development of the head in — *Neoceratodus*. ★Greil, A. 1908.1, 1913.1 — *Acipenser*. ★Kupffer, C. W. 1891.2, 1893.1 (i); — *Gobius*. Pollard, H. B. 1894.2. "Cirrhostomial" origin of the head. Pollard, H. B. 1894.1, 1895.1; — *Phylogenetic origin*. Ziegler, H. E. 1908.2.

Metamerism of head

Most of the references given below under Morphology include also Metamerism. In this connection, see also Embryo formation and Medullary tube under Embryology.

General researches on metamerism of the head. Dohrn, F. A. 1890.1; ★Hatschek, B. 1906.1, 1909.1, 1910.1; Hill, C. 1899.1, Add. 1900.1; Locy, W. A. 1897.1; Neal, H. V. 1898.1; Rabl, C. 1892.2; ★Severtzov, A. N. 1895.1; Wijhe, J. W. 1886.2; Kingsley, J. S. Add. 1896.1.

Metamerism of the head from the standpoint of the nervous system. Hawkes, O. A. 1905.2; ★Johnston, J. B. 1905.3; Neal, H. V. 1898.2; Stockard, C. R. 1908.1.

Metamerism of the head in *Cyclostomata* (*Petromyzon*). Kolikov, N. K. 1901.1, Add. 1899.1; Koltzoff, N. K. 1899.1; Neal, H. V. 1915.3.

Metamerism in *Selachii*. ★Brohmer, P. 1909.1; ★Dohrn, F. A. 1882.2 (xv, xviii, xxi, xxii); Killian, G. 1891.1; ★Severtzov, A. N. 1898.1, 2, 1899.2; Locy, W. A. Add. 1895.1; Matveev, B. Add. 1914.1.

Morphology of head

Miscellaneous and general papers on the morphology of the head of vertebrates including fishes. Ayers, H. 1890.1; Chaine, J. 1905.1; Froriep, A. 1902.1; Hilgard, T. C. 1857.1; Marshall, A. M. 1879.1; Neal, H. V. 1898.1; Norris, H. W. 1891.1; MacMurrich, J. P. Add. 1884.1.

Morphology of the head of various fishes. — *Scomber*. Allis, E. P. 1903.4. — *Embryo of Chlamydoselachus*. Brohmer, P. 1909.1. — *Dipnoi*. Fürbringer, K. 1904.3. — *Pristis and Pristiophorus*. Hoffmann, L. 1912.1. — *Amphioxus*. Wijhe, J. W. 1901.1. — *Acanthias*. Platt, J. B. 1891.1, 2. — *Macruridae*. Pfüller, A. 1914.1.

Anterior head cavities; structure and development, chiefly in *Selachii*. Boeke, J. 1903.1; Marshall, A. M. 1881.1; Platt, J. B. 1890.1; Reighard, J. E. 1901.1. — *Chlamydoselachus and Spinax*. Brohmer, P. 1909.1.

For the development of the head mesoblast, see under Mesoderm in section on Embryology.

Snout of fishes. Pereyaslavtzeva, S. 1876.1. — Occipital region of *Trutta*. Willcox, M. A. 1899.1. — Face of fishes, comparative anatomy. ★Winther, G. P. 1875.2, 1877.1.

Structure and biological significance of the "saw" of *Pristis* and *Pristiophorus*. Kölliker, R. 1860.5; Pappenheim, P. 1905.5.

For Frontal gibbosity, a swelling or protuberance on the heads of certain male fishes, *see under* Sexual dimorphism.

HEARING AND THE STATIC SENSE

Comprising the functions of the membranous labyrinth or ear.

For the morphology of the membranous labyrinth, *see under* Auditory organs.

For a complete résumé of the literature on hearing and the static sense in fishes, *see* ★Mangold, E. Add. 1912.1.

HEARING

Or the sense of audition

It has not yet been conclusively demonstrated that all fishes react to sound-waves.

Kreidl noted no reactions in goldfishes from vibrating rods held both in air and water, except when the fishes had been made more sensitive by strychnine and then the reactions took place even with the ear removed. It has, however, since been objected by Bigelow that the entire ear was not removed.

Parker (1904.2), experimenting with *Fundulus* and using the sustained slow vibrations of a bass viol string, observed reactions (fin movements) in only 18 per cent of fishes when the auditory nerves were cut, but in 94 per cent when the ears were intact and the skin insensitized. He thus definitely concluded that fishes react to sound waves.

Zenneck working with *Alburnus* and *Leuciscus* concluded that fishes *do* hear. He used an electric bell under water and noted activity when the bell was rung and sound-waves produced but inactivity when a piece of leather placed under the clapper of the bell inhibited the sound waves and produced mechanical vibrations instead. Bernoulli, repeating these experiments with eels and trout, obtained only negative results.

Hearing in fishes considered impossible on grounds of brain structure. Edinger, L. 1908.2.

Researches on detached heads of pike; on receiving stimulus of sounds through water, the otolith organ shows an increase of electro-negativity indicating momentarily active condition of the nerve and accepted as showing possibility of hearing. ★Piper, H. Add. 1906.1, 1911.1.

Evolution of hearing in vertebrates. Willem, V. Add. 1913.1.

Investigations of a technical or scientific nature on the sense of hearing in fishes. Bernoulli, A. L. 1910.1; Bigelow, H. B. 1904.1; Haempel, O. 1911.1; ★Körner, O. 1905.1; ★Kreidl, A. 1895.1, Add. 1896.1; Lafite-Dupont, J. 1907.1; Lee, F. S. 1898.1; Maier, H. N. 1909.1; Marage, — 1906.1; Nollet, — 1813.1; ★Parker, G. H. 1903.3, 1904.2, 1909.3; 1910.4; Zenneck, J. 1903.1, 1904.1.

Hearing in the blind cave-fish, *Amblyopsis*. Eigenmann, C. & Yoder, A. 1899.1; Payne, F. 1909.1.

Effects of explosive sounds. Parker, G. H. 1913.1; Zur Mühlen, M. 1911.26.

Sound as a directing influence in movements. Parker, G. H. 1910.2, 1912.2.

Movements of eye determined by hearing. Kubo, I. Add. 1906.1.

Observations, including anecdotes, miscellaneous notes, records, etc., recording the

belief of their writers that fishes possess the ability to hear.

Text in English. Baker, A. F. 1876.1; ★Bateson, W. 1889.1; Bell, J. C. 1904.1; Clapham, T. 1878.1; Lockington, W. N. 1879.3; Mackintosh, H. W. 1876.1; Redding, B. B. 1879.5.

Text in German. Beer, T. 1896.1; Blochmann, F. 1903.1; Brüning, C. 1906.1; Lang, A. 1902.1; Lenz, E. 1906.1; Piper, H. 1906.1; Plehn, M. 1905.2; Recker, H. 1898.1; Roth, W. 1910.1; Simroth, H. R. 1897.1; Sprenger, W. 1900.5; Zacharias, E. O. 1906.1; Anon. 553; Hensen, V. Add. 1904.1; Meyer, M. Add. 1909.1; Reinhart, H. Add. 1913.1.

Texts in other languages. — *Dutch.* Baster, J. 1762.2. — *Italian.* Ducceschi, V. 1903.1. — *French.* Geoffroy-Saint-Hilaire, E. 1824.3, 10. — *Hungarian.* Gorka, S. 1906.1. — *Swedish.* Iverus, I. E. 1899.1. — *Norwegian.* Møllers, H. T. 1865.1. — *Spanish.* Rivera, E. 1905.1. — *Latin.* Camper, P. Add. 1763.1.

Early references, in Pre-Linn. section. Arderon, W. 1750.1; Brockelsby, R. 1750.1; Camper, P. 1756.1; Denso, J. D. 1756.1; ★Klein, J. T. 1740.1–1747.1; Maurer, F. 1713.1; ★Nollet, J. A. 1746.1; Seger, G. 1688.1.

STATIC SENSE

Or maintenance of equilibrium

Including the perception of progressive movements and of position in space.

For Hydrostatic equilibrium, *see under* Air bladder.

For a related subject, *see* Locomotion.

The functions of the lateral line organs are intimately related to the general subject of hearing. For references, *see under* Lateral line system.

For a complete review of the literature on the static sense, *see* ★Mangold, E. Add. 1912.1.

Breuer's theory of semicircular canals and otoliths as organs for sensations of acceleration of movement or for sense of rotation. ★Breuer, J. 1874.1, 1890.1.

Researches on the maintenance of equilibrium, the functions of the semicircular canals, and otoliths, etc., through the destruction or excision of the membranous labyrinth on either one or both sides, transection of the auditory nerves, etc. Ayers, H. 1894.1; ★Bethe, A. 1894.1, 1899.1; Carazzi, D. 1898.1; Cyon, E. 1878.1, 1900.1; Ewald, W. F. 1907.1; Fröhlich, A. 1904.1; Gaglio, G. 1902.1; Lafite-Dupont, J. 1905.1; ★Lee, F. S. 1894.1, 1898.1; Monoyer, F. 1866.1, 2; Parker, G. H. 1910.1; Quix, F. H. 1903.1, 12; ★Sewall, H. 1882.1, 1884.1; Steiner, J. 1886.3, 1888.1; Chabry, L. M. Add. 1884.1; Kreidl, A. Add. 1892.1; Kubo, I. Add. 1906.1; Loeb, J. Add. 1891.2.

For effects of extirpation of canals and otoliths in the asymmetrical flounder, unfavorable to otolith hypothesis, *see* Lyon, E. P. in Amer. Journ. Physiol., 1899, vol. iii, pp. 98–104.

Hearing — Cont'd.

The ear as an organ for the perception of movements in the surrounding water. Tullberg, T. F. 1903.1.

Centers of localization of static sense in brain. Reisinger, L. 1915.1.

Effects of electric current on equilibrium. Alluaud, C. & Vlès, F. 1911.1.

Equilibrium considered due to fins. Gouriet, E. 1864.1, 1866.2; Houssay, F. 1909.1, 2, Add. 1912.1; Osburn, R. C. 1906.1.

Equilibrium considered due to action of both fins and air bladder. Müller, J. 1845.1.

The skin, lateral-line organs and ear as organs of equilibrium. ★Parker, G. H. Add. 1905.1.

HEART OF FISHES

For the other vascular organs, see Circulatory system.

For the coronary arteries and the lymphatics of the heart, see under Circulatory system.

For the "caudal heart," a pulsating lymph vessel, see Lymphatic system under Circulatory system.

Anatomy and morphology of heart.

For a general treatise on the comparative anatomy of the vertebrate heart, see ★Röse, C. 1889.1.

Miscellaneous and general. Braeunig, K. 1904.1; Döllinger, I. 1811.1; ★Dogiel, J. 1910.1; Gegenbaur, C. 1865.2; Hoyer, H. 1900.1; Hyrtl, C. J. 1859.2; Kerr, J. G. 1913.1; Marceau, E. 1902.1; Müller, J. 1845.4; Sabatier, C. P. 1873.1; ★Tiedemann, D. F. 1809.1; ★McWilliam, J. A. Add. 1885.1.

Anatomy of the heart in Elasmobranchii. François-Franck, C. A. 1913.1. — *Chimaera*. Lankester, E. R. 1879.1. — *Raja*. McQueen, J. M. 1913.1; Parchappe, M. 1848.1.

Morphology of heart in various fishes. — *Dipnoi*. Boas, J. E. 1880.1. — *Polyodon*. Danforth, C. H. 1912.1. — *Gadus*. Jourdain, S. 1867.2; Lubach, D. 1867.1. — *Teleosts*. Kasem-Beck, — & Dogiel, J. 1882.1; Keith, A. & Flack, M. 1907.1. — *Ceratodus* and *Protopterus*. Lankester, E. R. 1879.1. — *Acipenser*. Parchappe, M. 1848.1. — *Ammocetes* and *Petromyzon*. Vialleton, L. 1903.1.

Internal structure of heart in Plagiostomes and Ceratodus (figures). Garman, S. 1913.1.

Development and embryology.

Special researches. — *Cavity, manner of formation.* Ryder, J. A. 1885.10. — *First anlage.* Mollier, S. Add. 1906.1.

Development of heart in Cyclostomata. — *Petromyzon*. Hatta, S. 1897.1; Keiser, W. Add. 1914.1. — *Cyclostomes, Ganoids, Selachians*. ★Rückert, J. & Mollier, S. Add. 1906.1.

Development in Elasmobranchii. ★Hoffmann, C. K. 1892.1, 1893.2, Add. 1892.1; Mayer, P. 1887.1; Rückert, J. 1888.1. — *Raja*. Weber, A. 1908.1.

In Teleostei (and Lepidosiren). Borcáa, J. 1909.3; Mollier, S. 1906.2. — *Esox*.

Aubert, H. 1855.1. — *Lepidosiren*. Robertson, J. I. 1913.1. — *Alosa*. Senior, H. D. 1909.1. — *Salmonidae*. ★Sobotta, J. 1894.1, 1902.1. — *Lophobranchii*. Weber, A. 1906.1, 1906.4.

Histology and histogenesis of heart.

Elastic fibers. Pogonowska, I. 1911.1; Gregory, E. H. Add. 1897.1; Schumacher, S. Add. 1898.1.

Endocardium, the epithelial lining of the heart, origin. Holbrook, A. T. 1894.1; Stricht, O. 1896.2.

Histogenesis of myocardium, heart-muscle, muscle-fibers, etc. Boeke, J. 1903.3; Gulliver, G. 1842.1; Macallum, A. B. 1897.1; Retterer, E. & Lelièvre, A. 1909.2; Schockaert, A. 1909.1; Stannius, F. H. 1853.1.

Innervation of the heart. *Distribution of nerve fibers, ganglia, etc.* Bottazzi, F. 1901.1; Sala, L. 1910.1; Vignal, W. V. 1880.1.

Cardio-regulatory nerves. — *Present in Ichthyomyzon.* Carlson, A. J. 1906.1. — *Absent in Bdellostoma.* Greene, C. W. 1900.1, 1902.1. — *Origin in brain.* Kreidl, A. 1899.1.

Cardio-regulatory nerves, chiefly the vagus, experimental researches on inhibition, etc. Cadiat, L. O. 1879.1; McWilliam, J. A. 1884.1; Mills, T. W. 1886.1; Hemmeter, J. C. Add. 1914.1, 2.

Physiology: experimental researches on heart action in fishes.

For a general treatise on the physiology of the heart of fishes, see ★Tschermak, A. 1909.1.

Results of experimentation on the heart action of — Selachii. Baglioni, S. 1906.2; François-Franck, C. A. 1913.1; Meyer, J. 1910.1. — *Bdellostoma*. Carlson, A. J. 1904.1. — *Teleostei*. Kasem-Beck, — & Dogiel, J. 1882.1; Knox, R. 1822.1; Kolff, W. M. 1907.1–1908.1; McWilliam, J. A. 1884.2, Add. 1884.1, 1885.1; Thesen, J. E. 1896.1.

Cardiac rhythm, general accounts. Bätke, H. 1898.1; ★Dogiel, J. 1910.1; Mills, T. W. 1886.1; Mines, G. R. 1913.3; Boyle, R. Pre-Linn. 1670.1.

Effects of temperature on heart action. Babák, E. & Hepner, J. 1912.1; Polimanti, O. 1911.4.

Various unclassifiable experimental physiological papers. — *Influence of spinal marrow.* Clift, W. 1815.1, 2, 1816.1. — *Vitality of heart in a shark.* Dawson, John, 1852.1. — *Influence of activity.* Mines, G. R. 1913.1. — *Continuation after asphyxiation.* Polimanti, O. 1914.1.

Effects of various reagents. — *Influence of urea, Selachii.* Baglioni, S. 1905.1, 1906.1. — *Dependence upon oxygen.* Loeb, J. & Wasteneys, H. 1912.2. — *Relation to electrolytes.* Mines, G. R. 1907.1, 1911.1. — *Relation to concentration of sea water.* Schively, M. A. 1893.1.

For the effects of saline solutions on cardiac activities, see Alkaline media under Physiology.

For the influence of poisons on the heart action, see Drugs, alkaloids, etc., under Physiology.

For methods of recording the action of the heart by electro-cardiography, see Technique and methods.

PARTS OF HEART

Chambers of the heart of fishes.

Bulbus arteriosus, anatomy and physiology. Carlet, G. 1876.1; Favaro, G. 1911.1; Gegenbaur, C. 1865.2, 1866.2.

Conus arteriosus, anatomy and morphology in—*Butirinus*. Boas, J. E. 1879.1. —General. Favaro, G. 1911.1; Gegenbaur, C. 1891.1. —*Ceratodus* and *Protopterus*. Lankester, E. R. 1879.1. —*Megalops*. Senior, H. D. 1907.1, 2, 3. —*Selachii*, *Chimaeroids* and *Ganoids*. Stöhr, P. A. 1876.1, 1877.1.

Sinus venosus, development and physiology. —Pulsation in *Anguilla*. Delchaf, J. 1905.1. —Development of walls. Lafite-Dupont, J. 1910.1.

Truncus arteriosus. Development. Greil, A. 1903.1.

Ventricle, structure of. Rathke, M. H. 1826.2, 3.

Pericardium, or pericardial sac. —Help in formation of "diaphragm." Bertelli, D. 1898.1. —Pericardial communication with peritoneum in *Elasmobranchii*. Delaroche, F. E. 1808.1.

Valves, structure, development, and action. Favaro, G. 1911.2; Pettigrew, J. B. 1866.1.

HERMAPHRODITISM

The following summary accurately represents the existing state of knowledge with regard to hermaphroditism in fishes. There is no comprehensive treatise on this subject known to us and no other account contains more information than the present.

For the normal structure of the reproductive organs, see under Urinogenital system.

The occurrence of hermaphrodite genital glands in fishes (especially in the Teleostei) is widespread.

An illuminative summary of hermaphroditism in fishes, is ★Howes, G. B. 1891.1.

Other general accounts, with collations of records are Gemmill, J. F. 1912.1; Syrski, S. 1876.2; ★Weber, M. 1884.1.

Discussions of phylogenetic derivation of hermaphroditism. Howes, G. B. 1891.1; Masterman, A. T. 1895.2.

Miscellaneous or unclassified papers on hermaphroditism. Cori, C. J. 1906.2; Hoek, P. P. 1890.5, 1891.1; Lönnberg, A. J. 1897.1; Martens, E. 1879.2; Starcke, J. H. Pre-Linn. 1700.1.

Petromyzon, *Anguilla*, and *Conger*, thought to be hermaphroditic and self-fertilizing. Home, E. 1823.1.

While there are intergradations, the following two subdivisions may be maintained, namely Functional, and Teratological hermaphroditism.

Functional Hermaphroditism

Being normal in the forms mentioned, in that the functional production of both ova and spermatozoa takes place. It seems to be now generally accepted that in these forms, hermaphroditism is the regular mode of reproduction.

CYCLOSTOMATA

"*Myxine glutinosa* is a protandric hermaphrodite [anterior end of gonad (ovotestis) being male, and posterior, female]. Up to a body-length of about 32 or 33 centimeters, it is a male, after that time it produces ova." Nansen, F. 1887.1 (p. 29).

Cunningham concluded that young "females are nearly, but not quite always hermaphrodite, and that the testicular portion normally disappears as the eggs become more mature." Cunningham, J. T. 1887.4 (p. 73).

These conclusions were questioned and differently interpreted by Dean, B. 1899.6 (p. 227).

The subject has been reviewed and the original conclusions of Nansen maintained, by ★Schreiner, K. E. 1904.2.

Although denying protandric hermaphroditism, Cole says, "every adult *Myxine* is hermaphrodite, but either predominantly male or female . . . [having] either a mature testis and a rudimentary ovary, or a mature ovary and a rudimentary testis." Cole, F. J. 1905.2 (p. 324).

Similar conditions in the brook lamprey (*Lampetra*) are reported by Okkelberg, P. 1914.1, who states "a juvenile hermaphroditic condition occurs normally" and that "all the hermaphrodites develop into males."

Of forty-nine larval forms of *Petromyzon* examined, one-fourth showed hermaphroditic characters, according to Lubosch, W. 1903.1.

The occurrence of a characteristic ovum among the spermatozoa in the testis of lampreys (*Petromyzon*), has been independently noted by Beard, J. 1893.1, and Ward, R. H. 1897.1.

J. L. Conel (Journ. Morph. 1917, vol. 29, p. 133) after studying the urinogenital system believes it "impossible that *Myxine* can be a protandric hermaphrodite."

TELEOSTEI

Serranus cabrilla, *S. hepatus*, and *S. scriba*, described as being functionally hermaphroditic, and self-fertilising through the simultaneous expulsion of ova and sperm. Dufossé, A. 1854.1. These (anatomical) observations seem to be corroborated by Brock, J. 1878.1 (p. 568).

In *Chrysophrys auratus* (Sparidae), invariably hermaphroditic, the male and female genital products ripen alternately. Brock, J. 1878.1.

Protandrous hermaphroditism suggested for the cyprinid, *Scardinius erythrophthalmus*. Stéphan, P. 1901.1. —Comment on this. Roule, L. 1902.3.

Hermaphroditism — Cont'd.**Teratological Hermaphroditism**

In these forms, hermaphroditism is only occasionally met with and is thus an abnormal or teratological condition.

As contrasted with conditions in other groups of vertebrates where "the dominant condition is that of replacement of one of the two testes in an ovary, or vice versa, in the Teleostei it is that of differentiation of the same gland into organically continuous ovary and testis." Howes.

Recorded instances of hermaphroditism, in the fishes listed below.

In general, the literature is limited to anatomical descriptions. Actual expulsion of both sperm and ova from the same individual has to our knowledge not been observed, although it doubtless occurs.

A few older records additional to these will be found in ★Weber, M. 1884.1.

CEPHALOCHORDATA

Of twenty-five gonads on the left side of an *Amphioxus*, one is an ovary and all others are testes full of sperm. Goodrich, E. S. 1912.1, 1913.1.

A male specimen of *Amphioxus* with forty-three gonads shows one, the fifth anterior left gonad, containing ova. Orton, J. H. 1914.1.

Langerhans stated that he detected the tails of sperm among the ovarian ova of *Amphioxus*. Langerhans, P. 1876.2 (p. 326).

SELACHII

A female specimen of *Raja clavata* presented a small testis on the left side. Hoek, P. P. 1894.1.

A female of *Scyllium stellare* showed on the right side a testis without a duct. Vayssiére, A. & Quintaret, G. 1914.1.

TELEOSTEI

Burbot (*Lota*); recorded cases of hermaphroditism. Järvi, T. H. 1909.3, 4; Luther, A. F. 1909.2; Pipping, J. G. 1800.1; Sandman, J. A. 1909.2; Schneider, G. 1903.13.

Carp (*Cyprinus carpio*). Jäckel, A. J. 1867.1; Alischer, S. Pre-Linn. 1720.1; Brückmann, F. E. Pre-Linn. 1734.1; Morand, S. Pre-Linn. 1740.1. Schwalbe, — Pre-Linn. 1734.1.

Eel (*Anguilla*); alleged hermaphroditism. Ercolani, G. B. 1871.1–1872.2; Nardo, G. D. 1871.2; Anon. 7.

Gadidae; hermaphroditism recorded in the — Cod (*Gadus morrhua*). Halbertsma, H. J. 1864.1; Hefford, A. E. 1907.2; Hoek, P. P. 1890.4; ★Howes, G. B. 1891.1; Masterman, A. T. 1895.2; Smith, John A. 1867.9, 1870.1; Williamson, H. C. 1906.2. — Whiting (*G. merlangus*). Debierre, C. 1887.1. — Ling (*Molva vulgaris*). Kyle, H. M. 1897.1. — Haddock (*G. aeglefinus*). Smith, W. R. 1891.2.

Herring (*Clupea harengus*); cases of hermaphroditism. Freund, L. 1909.1;

Malm, A. W. 1865.2, 1873.1, 1877.3, 4; ★Münter, J. A. 1877.1; Pidgeon, D. 1898.1; Sandman, J. A. 1906.6; Sjöberg, H. R. 1911.1; Smith, John A. 1870.1; Smitt, F. A. 1882.1; Southwell, T. 1902.2; Vogt, C. C. 1882.1; Yarrell, W. 1845.1; Langrand, E. Add. 1914.1.

Perch, chiefly *Perca fluviatilis*. Hermaphroditism recorded. Halbertsma, H. J. 1864.1; Hoek, P. P. 1890.5; Ivanzov, N. 1893.1; Skogman, A. 1910.1.

Salmonidae, cases of hermaphroditism. Couch, J. 1868.1; Simpson, J. Y. 1839.1; Stewart, C. 1891.2.

Cases of hermaphroditism in — Shad (*Alosa*). Fowler, H. W. 1912.2. — Rutilus. Fuhrmann, O. 1909.2, 1910.1. — *Sargus annularis*. MacLeod, J. 1881.2. — Mackerel (*Scomber*). Malm, A. W. 1873.1, 1874.4, 1877.3, 4; Stewart, C. 1891.1. — *Fundulus majalis*. Newman, H. H. 1908.2. — Mugil. Orlandi, S. 1902.1. — *Neomænis* and *Ocyurus*. Poey, F. 1870.2. — *Gasterosteus*. Schneider, G. 1904.16. — *Sargus* and *Smaris*. Stéphan, P. 1902.1.

HIBERNATION

Hibernation or winter sleep, the torpid condition in which fishes survive the low temperatures and lack of food during winter.

Miscellaneous. Carradori, G. 1797.1; Cunisset-Carnot, — 1909.1; Schubart, A. 1913.1; Sundvik, E. E. 1895.1; Zuntz, N. 1905.1; Anon. 728. — Due to environmental conditions in winter. ★Knauthe, K. 1899.1.

Hibernation of various fishes. — Carp. Borodin, N. A. 1906.2; Supino, F. 1911.1, 2. — Black bass. Henshall, J. A. 1885.1. — Hippocampus. Rusconi, M. 1819.1.

For the manner in which fishes endure the dry season of tropical countries, see Aestivation.

HISTORICAL MATTER

For Historical matter concerning specific subjects, see under such topics as Fisheries, Pisciculture, etc.

For the history of ichthyology, see under Ichthyology.

For reproductions of ancient figures of fishes, see Iconography.

For legends, superstitions, etc., see under Mythology.

For fishes of the Bible, see Theology.

For a valuable recent work in English, treating of the part played by fishes and fishing in the economic and religious life of the Greeks and Romans, Egyptians, Assyrians, Jews, and Chinese, see ★Wm. Radcliffe. "Fishing from the earliest times." London. 1921. 478 p. illus.

Animals mentioned in "Don Quixote." Colmeiro y Penido, M. 1895.1. — The earliest mention of fossil fishes. Eastman, C. R. 1904.3. — Old Arabic, Hebrew and German writings on anatomy. Hyrtl, C. J. 1879.1, 1884.1. — The animal lore of Shakespeare's time. Phipson, E. 1883.1.

General treatises. *Histories of natural sciences from the earliest times to the present.* ★Carus, J. V. 1872.1, 1880.1; ★Cuvier, G. 1841.1; Dannemann, J. F. 1896.1; Haeckel, E. H. 1908.1; Jaeger, O. 1897.1; ★Locy, W. A. 1908.1; ★Miall, L. C. 1911.1, 1912.1; ★Osborn, H. F. 1894.1; Spix, J. B. 1811.1; Wimmer, J. 1903.1, 1905.1; Woodward, B. B. 1905.1.

Greek and Roman ichthyology.

Three fishes of the ancients: Lucerna, Charax, and Hyaena. Bouros, G. 1840.1. — *For Glanis of ancient Greeks and Romans, see Parasilurus.*

Natural history knowledge of the ancients.

Eastman, C. R. 1905.4; Pleyel, J. 1905.1; Schneider, J. G. 1782.1, 1783.1; Schvarcz, G. 1862.1; Sophocles, E. A. 1860.1; ★Strunz, F. 1904.1; ★Voigt, G. 1893.1; ★Lenz, H. O. Add. 1856.1; Schneider, K. Add. 1892.1.

The Pre-Aristotelians. Mieli, A. 1916.1. — *Review of this.* Thompson, D. W. 1916.1.

Reference should be made in the Pre-Linn. section to the following classical writers, most representative of their time. Aelian, C. 1533.1; ★Aristotle. 1476.1; Arrian, F. 1508.1; ★Athenæus, N. 1514.1; Caesarius, J. 1518.1; Cassiodorus, M. A. 1579.1; Figulus, P. N. 1492.1; Homer. 1488.1; ★Oppian. 1478.1; Ovid 1471.1; ★Pliny, C. 1469.1; Pollux, J. 1608.1; Solinus, C. J. 1475.1; Suidas, — 1499.1; Theocritus. 1678.1.

Mediæval knowledge. *Popular treatises on science in the Middle Ages.* Moule, H. M. 1868.1; Pouchet, F. A. 1853.1; Wright, T. Add. 1841.1.

Bestiaries (MSS.) of the 12th and 13th Centuries. Morgan, J. P. 1906.1; Anet, C. Add. 1913.1. — *Codex Ricardiano, 1357.* McKenzie, K. 1905.1. — *Ecbasis captivi, 940.* Voigt, E. 1875.1.

Reference should be made in the Pre-Linn. section to the following representative writers of the Renaissance. Albertus Magnus 1478.1; Cardano, G. 1550.1; Cirino, A. 1653.1; Clusius, C. 1605.1; Freigius, J. T. 1579.1; Massarius, F. 1734.1; Musurus, M. 1515.1; Phile, M. 1533.1.

Modern period. *History of zoology.* — *In Austria, 1850–1900.* Steindachner, F. 1901.2. — *In America.* Wilson, H. V. 1912.1.

HYBRIDS AND HYBRIDIZATION

Among fishes, hybrids have been recorded only from the Teleostei.

For the short life of spermatozoa in water after their expulsion, which has been suggested as an adaptation for the prevention of hybridization, see *Duration of virility under Spermatozoa.*

For general treatises with enumeration of hybrids in all groups of animals (accounts of fishes rendered obsolete however by the present list), consult ★Ackermann, K. 1898.1; Day, F. 1890.1; and Suchetet, A. 1888.1 (vol. 24 of *Revue Q. S.*).

Cross-fertilization Experiments

Fertilization of ova with spermatozoa of remotely related forms. In general, development of such heterogenic hybrids ceases during cleavage stages.

Various experiments with marine fishes. Appellöf, A. 1894.1; Fulton, T. W. 1890.2; List, J. H. (*Labridæ*) 1887.1; McIntosh, W. C. 1891.3.

Individuality of maternal and paternal chromosomes in hybrids. Moenkhaus, W. J. 1903.2–1911.1; Morris, M. 1914.1; Hertwig, G. & Hertwig, P. Add. 1914.1.

Heredity of pigmentation in hybrids. Bancroft, F. W. 1911.1, 1912.1; Bataillon, E. 1900.7; Loeb, J. Add. 1898.1.

Heredity as exhibited by hybrids. Newman, H. H. 1908.1, 1910.1–1915.1.

*A recent paper "The initial block to normal development in cross-fertilized eggs" by Edith Pinney, relating experiments with eggs of *Fundulus* and reciprocal crosses between *Ctenolabrus* and *Prionotus*, appears in the Journal of Morphology, 1922, vol. 36, pp. 401–415, 2 pls.*

Genetical Work

The only researches on hybridizing fishes from the viewpoint of modern genetics, known to us, are the experiments with *Pæciliidæ*, cited below under ★Gerschler, M. W. Add. 1914.1–1914.3.

Some of the results of this work are discussed under Sex-determination under Embryology.

*For various statistical "racial studies," which involve breeding experiments with fishes (*Zoarces*, *Lebistes*, and *Salmo fario*), consult the series by Johs. Schmidt, in the Journal of Genetics, 1918, vol. 7, pp. 105–118; 1919, vol. 8, pp. 147–153; 1920, vol. 9, pp. 61–67; 1920, vol. 10, pp. 179–191. These are summaries of articles appearing in the "Comptes-Rendus des travaux du Laboratoire Carlsberg, Copenhagen."*

They tend to show that "racial characters" are of genotypical or hereditary constitution.

Hybrids in Cyprinidæ

Occurring under natural conditions except where noted. More hybrids have been recorded from this family than any other, and with few exceptions are European.

Faunal treatises including accounts of hybrids of Cyprinidæ. ★Fatio, V. 1882.1; Regan, C. T. 1911.8; Siebold, C. T. 1863.1; Smitt, F. A. 1893.1.

Miscellaneous papers on German hybrids of Cyprinidæ. Bade, E. 1904.1; Heincke, F. 1892.1; Knauthe, K. 1896.6, 1902.3, 1903.1; Leonhardt, E. E. 1903.1. — *Goldfish hybrids.* Lefebvre, A. 1881.2; Stoll, A. A. 1907.1.

List of recorded hybrid forms, with names given them by systematists under the assumption that they were natural species:

Abramis brama × *Rutilus* (*Leuciscus*) *rutilus*. (*Abramis buggenhagii* of Bloch; *A. leuckartii* of Heckel; *Abramidopsis* of Siebold). — *Synonymy.* Fatio, V. 1882.1 (p. 347). — *A. leuckartii* believed to be

Hybrids — Cont'd.

hybrid of *A. brama* and *Leuciscus* sp. Kner, R. 1864.1. — Occurrence in Germany and Finland. Grube, A. E. 1867.1; Krauss, F. 1863.2; Luther, A. F. 1904.1; Stenroos, K. E. 1893.1, 1895.1; Westerlund, A. 1898.1.

Abramis melanops × *Rutilus rutilus*. (*Abramidopsis rhinosimus* of Jäckel). Jäckel, A. J. 1869.1.

Abramis brama × *Scardinius erythrophthalmus*. "White roach" of Lough Erne, Ireland. Regan, C. T. 1908.14.

Alburnus albonellus × *Leuciscus cavendishii*. From Lake Lugano. Fatio, V. 1905.4.

Alburnus lucidus × *Leuciscus cephalus*. (*Alburnus dolobratus* of Hollandre.) Synonymy. Fatio, V. 1882.1 (p. 452).

Alburnus lucidus × *Leuciscus leuciscus*. Recorded. Leonhardt, E. 1904.15.

Alburnus lucidus × *Leucaspis deloneatus*. Artificially induced fertile hybrids (*Alburnus leydigii*). Knauthe, K. 1893.2, 4, 1895.4.

Alburnus lucidus × *Rutilus rutilus*. From R. Nene, England. Günther, A. C. 1889.5.

Alburnus lucidus × *Scardinius erythrophthalmus*. *Alburnus rosenhaueri* of Jäckel, A. J. 1865.1, 1866.1. — *Scardiniopsis alburniformis* of Benecke, B. 1884.1.

Blicca bjoerkna × *Alburnus lucidus*. (*Bliccopsis alburniformis* of Siebold). Jäckel, A. J. 1864.1–1866.1. — Considered hybrid of *B. bjoerkna* and *Abramis brama*. Knauthe, K. 1895.1.

Blicca bjoerkna × *Leuciscus meidingeri*. (*Bliccopsis melanopterus* of Jäckel). Jäckel, A. J. 1869.1.

Blicca bjoerkna × *Rutilus rutilus*. (*Abramis abramo-rutilus* of Hollandre, *Bliccopsis* of Siebold). — Synonymy. Fatio, V. 1882.1 (p. 387). — Status. Gensoul, J. 1908.2; Vutskits, G. 1907.1, 1913.1. — Believed to be a hybrid between *Abramis* sp. and *L. rutilus* or *S. erythrophthalmus*. Kner, R. 1864.1.

Blicca bjoerkna × *Scardinius* (*Leuciscus*) *erythrophthalmus*. (*Bliccopsis erythrophthalmoides* of Jäckel). Fatio, V. 1882.1 (p. 376); Jäckel, A. J. 1864.1; Knauthe, K. 1895.2. — Occurrence in Finland. Luther, A. F. 1901.1; Stenroos, K. E. 1895.1.

Carassius auratus × *Barbus conchionius*. Artificially induced. Leonhardt, E. E. 1905.21.

Cyprinus carpio × *Barbus vulgaris*. Recorded. Defay, — 1785.1.

Cyprinus carpio × *Carassius auratus*. Artificially induced. Fischer, F. 1880.1.

Cyprinus carpio × *Carassius vulgaris*. (*Carpio kollarii* of Heckel). — Considered a distinct form, *C. kollarii*. Heckel, J. J. 1836.3; Heckel, J. J. & Kner, R. 1858.1; Kner, R. 1864.1. — Shown to be a hybrid. ★Dybowski, B. J. 1864.1. — Synonymy. Fatio, V. 1882.1 (p. 198). — Fertility. Knauthe, K. 1893.4, 1895.4.

Cyprinus carpio × *Tinca vulgaris*. Artificially produced. Friedel, E. 1880.2 (p. 333).

Leuciscus agassizii × *Chondrostoma nasus*. (*Chondrostoma rysela* of Agassiz). — Synonymy. Fatio, V. 1882.1 (p. 724). — Occurrence. Murisier, P. 1911.1.

Leuciscus cephalus × *Chondrostoma nasus*. Description. Fatio, V. 1882.1 (p. 706).

Leuciscus aulatus × *Scardinius erythrophthalmus*. From Lago di Varano, Italy. Bellotti, C. 1904.1; Chiappi, T. 1902.1.

Rhodeus amarus × *Leucaspis deloneatus*. Recorded. Knauthe, K. 1896.1.

Rutilus rutilus × *Scardinius erythrophthalmus*. (*Scardiniopsis anceps* of Jäckel). Gensoul, J. 1908.2; Jäckel, A. J. 1864.1, 1865.1.

Hybrids in Pleuronectidae

Alleged or supposed hybrids, chiefly existing under natural conditions.

Faunal treatises including accounts of supposed hybrids from Baltic and North Seas. Möbius, K. & Heinke, F. 1883.1; Smitt, F. A. 1893.1.

Pleuronectes limanda × *Pleuronectes flesus*. Day, F. 1885.7.

Pleuronectes platessa × *Pleuronectes limanda*. Duncker, G. 1892.2.

Pleuronectes platessa × *Pleuronectes flesus*. (By artificial fertilization). Kyle, H. M. 1900.4.

Pleuronectes platessa × *Rhombus maximus*. Krause, K. E. 1883.1.

Rhombus maximus × *Rhombus laevis* (*R. hybridus* of Malm). Occurrence in nature, of turbot and brill hybrid. Holt, E. W. 1893.3; Malm, A. W. 1877.2. — Artificially produced. McIntosh, W. C. 1891.3.

Hybrids in Pöcillidae

Hybrids in these viviparous forms, produced through crossing aquarium fishes. Because of superfecundation, many former references to alleged hybrids are worthless.

Xiphophorus helleri × *Platyphacelus maculatus*. Male *Xiph.* (*strigatus*) and female *Platyp.* Haffner, C. 1912.4, 1913.1. — Note on this. Wolterstorff, W. G. 1913.1. — The reciprocal cross; female *Xiph.* and male *Platyp.*; back-crossing and other crosses. ★Gerschler, W. M. Add. 1914.1–1914.3.

Pöcilia mexicana × *Molliensia latipinna*. Male *Pöcilia*. Scheljuzhko, L. 1912.1.

The citations (partly oviparous forms) under Fischer, M. 1911.1; Hey, F. 1910.1; Starkloff, C. 1913.1; and Thumm, J. 1905.1, refer chiefly to the *Blätter für Aquar. u. Terrar. Kunde*. Search through this series should disclose additional alleged hybrids.

Hybrids in Salmonidae

With the exception cited below, of *Salmo schiffmülleri* occurring naturally in Austrian lakes, the numerous hybrids listed here have all been produced through artificial

fertilization by the fish-culturists. The Salmonidae have always occupied their chief interest.

The centers of such hybridization have been the experiments of Sir James Maitland at Howietoun recorded by Day and those of Seth Green of the New York hatchery, cited below and further recorded by R. B. Roosevelt in *Proc. Amer. Assoc. Adv. Science*, 1884, vol. 33, pp. 510-515.

Miscellaneous and unimportant items. Baird, S. F. 1873.18; Green, S. 1879.2, 1880.2, 4; Grieg, J. A. 1906.1; Hallock, C. 1873.5; Mather, F. 1876.6; Rasch, H. H. 1867.2; Smith, E. V. 1915.1; Anon. 387.

Experiments of Sir J. R. Gibson-Maitland at Howietoun, near Stirling, Scotland. ★Day, F. 1884.6, 1885.5, 8, 1887.1, 1888.1, 1890.1. — Notice of this work. Behrens, G. 1885.1.

List of hybrid forms, all reared to maturity unless otherwise stated:

Oncorhynchus tshawytscha (milt) × *Salvelinus fontinalis* (eggs). Four-year old females developed eggs too large to void and evidently infertile. Green, S. 1882.1; Roosevelt, R. B. 1880.1, 1881.1.

Oncorhynchus sp. × *Oncorhynchus* sp. Crosses between various species, fry only. Richardson, J. A. 1906.1.

Salmo salar × *Salmo fario*. Infertile hybrids produced — at Hüningen, Alsace. Arens, C. 1894.1; Haack, H. 1880.6, 1894.1. — at Winkelsmühle near Düsseldorf. Overbeck, G. 1880.2. — Review of these experiments. Leuckart, C. G. 1882.1, 2. — Three-year old hybrids developed eggs, in similar cross of Lochleven trout (eggs) and salmon. Day, F. 1882.4, 1885.8.

Salmo fario × *Lota marmorata*. By artificial fertilization. Fraas, C. N. 1854.1.

Salmo fario × *Salvelinus fontinalis*. Lochleven trout eggs with brook trout milt. Hybrids fertile. Day, F. 1882.9, 1884.6, 1885.8.

Salmo fario (including *Trutta lacustris*) × *Salvelinus salvelinus*. — This cross first produced at Bärau near Gmunden, Austria. Kner, R. 1865.4. — Produced at various localities in Germany and Russia. Arens, C. 1893.1; Haacke, J. W. 1893.1; Knoch, J. Add. 1884.1. — *Salmo schiffermülleri* Bloch, (*Silberlachs*) because of similarity of bred examples, considered a sterile hybrid possibly of this cross. Fitzinger, L. J. 1875.1. — 1876.1.

Salmo fario × *Salvelinus umbla*. Crossed in France. Bruyant, C. 1910.1; Crettiez, J. 1906.1. — This hybrid rec'd at U. S. Nat. Museum from Norway. Bean, T. H. 1889.20, Add. 1889.1.

Salmo irideus × *Salvelinus fontinalis*. Sterile hybrids. Zalsman, P. G. 1914.1. — Supposed hybrids from Wytheville station. Bean, T. H. Add. 1889.1.

Salmo irideus × *Salvelinus umbla*. Rainbow trout eggs fertilized with milt of Ombre-chevalier. Crettiez, J. 1906.1.

Salvelinus alpinus × *Salvelinus fontinalis*. Scotch charr milt and Amer. charr eggs. Hybrids fertile but second hybrid

generation died before maturity. Day, F. 1884.6, 8, 1885.8.

Salvelinus fontinalis × *Salvelinus aureolus*. Crossed at Sunapee L. hatchery. Hybrids fertile. Bean, T. H. 1910.8.

Salvelinus fontinalis × *S. (Cristivomer) namaycush*. Crossed at Corry station, Pa. Bean, T. H. 1889.3, 7, 9, 1890.32, Add. 1889.1. — Fertile hybrids at N. Y. hatchery. Green, S. 1880.2, 1882.1.

Various hybrid fishes

Chiefly of digeneric types, and occurring in nature unless otherwise stated.

Clupea pilchardus × *Clupea harengus*. Day, F. 1887.6.

Clupea alosa × *Clupea finta*. Believed to produce hybrids. Hoek, P. P. 1899.1.

Alosa sapidissima × *Pomolobus pseudoharengus*. Alleged appearance of adults in Hudson R. after planting of this cross. Roosevelt, R. B. 1881.1.

Alosa sapidissima × *Roccus lineatus*. Artificially produced. Ryder, J. A. 1883.1, 1887.2.

Salmo fario × *Lota marmorata*. Through artificial fertilization. Fraas, C. N. 1854.1.

Perca fluviatilis × *Acerina cernua*. Found in nature and also produced by artificial fertilization. ★Kammerer, P. 1907.2.

Gobio fluviatilis × *Leuciscus phoxinus*. Knauthe, K. 1891.1.

Chænobryttus gulosus × *Lepomis gibbosus*. Radcliffe, L. 1914.1.

Heros facetus × *Geophagus gymnogenys*. Schütz, R. 1912.1.

For hybrids between pike (*Esox lucius*) and pickerel (*E. reticulatus*), see G. C. Embury, in *Journ. Hered.* 1918, vol. 9, pp. 253-256, 2 pls. Also O. W. Smith, "The Book of the Pike," 1922, pp. 185-189.

ICHTHYOLOGY

For histories of natural sciences including ichthyology, see Historical matter.

Historical accounts. Essays on the history of ichthyology. Boulenger, G. A. 1910.3; Cuvier, G. & Valenciennes, A. 1828.1 (vol. 1); Günther, A. C. 1910.1; ★Jordan, D. S. 1902.5. — Reprinted in 1905.1; ★Lönnberg, A. J. 1901.5.

Development of American ichthyology. Gill, T. N. 1904.8; ★Goode, G. B. 1884.2, 1888.2; Lockington, W. N. 1882.2.

Works of a general nature

For compendia, dictionaries, encyclopedias, natural histories, works of a popular or non-technical nature relating to fishes, etc., see the section entitled General works on natural history.

For treatises on the fauna of a definite region, see the desired locality under Fauna of the world.

General works of a technical or precise nature: introductory studies, guides to studies, etc.

Text in English. ★Boulenger, G. A. 1895.2, 1904.7; ★Bridge, T. W. 1904.1; ★Dean, B. 1895.4; Gill, T. N. 1881.1, 1896.18, Add. 1881.1; ★Goode, G. B. 1888.1, 1903.1; Girard, C., Suckley, G. & Agassiz, L. 1857.1; ★Goodrich, E. S.

Ichthyology — *Cont'd.*

1900.1; Griffith, E. 1834.1; Günther, A. C. 1859.1, 1880.4, 1894.2, 1902.1; Jones, T. 1847.1; ★Jordan, D. S. 1905.1, 1907.1; Monro, A. 1785.1, 1787.1; Richardson, J. 1856.1; Ward, Samuel, 1770.1, 1775.1, 1776.1; Wilson, J. 1838.1, 2.

Text in French. Ajasson de Grandsagne, J. B. 1828.1–1829.2; Auboin, S. 1831.1; ★Bloch, M. E. 1782.1, 1785.1, 2, 1786.1, 1801.1; Bonnaterre, J. P. 1788.1; Buffon, G. L. 1803.1; Castel, R. L. 1801.1; ★Cuvier, G. & Valenciennes, A. 1827.1, 1828.1; Daubenton, L. J. 1782.1; Dumeril, A. M. 1856.2; Dumeril, A. H. 1865.3; Goüan, A. 1770.1; ★Lacépède, B. G. 1795.1, 1798.1, 1803.1, 1819.2, 1844.1, 1878.1; Sauvage, H. E. 1865.1; Sonnini de Manoncourt, C. N. 1803.1; ★Valenciennes, A. 1837.1, 1850.1.

Text in German. Bechstein, J. M. 1797.1; ★Favaro, G. 1908.1; ★Favaro, G. & Mozejko, B. 1913.1; Gmelin, C. C. 1829.1; Goüan, A. 1781.1; Günther, A. 1886.2; Haempel, O. 1912.1; Heppe, J. C. 1782.1, 1800.1; Lacépède, B. G. 1799.3, 1833.1; ★Lönnberg, A. J. 1901.5; Minding, J. 1832.1; Schinz, H. R. 1836.1; Schmid, K. 1822.1.

Text in Latin. Broussonet, P. M. 1782.1; Goüan, A. 1770.1; Walbaum, J. J. 1788.1; Wulff, J. C. 1765.1.

Earlier works on ichthyology, in Pre-Linn. section. ★Aldrovandi, U. 1613.1; ★Artedi, P. 1738.1; ★Belon, P. 1551.1, 1553.1; Bodin, J. 1555.1; Boussuet, F. 1558.1; ★Gesner, C. 1556.1, 1558.1, 1563.1; Giovio, P. 1524.1, 1527.1; Klein, J. T. 1740.1; ★Rondelet, G. 1554.1; ★Salviani, H. 1554.1; ★Willughby, F. 1686.2; Anon. 734, 757, 764.

ICONOGRAPHY

Comprising plates or illustrations of fishes.

For the fish symbol in art, see under *Mythology and Symbolism*.

See also *Archæology*, for ancient fish paintings, carvings, etc.

General collections. Bloch, M. E. 1786.1, 1787.1; Blumenbach, J. F. 1797.1; Buc'hoz, P. J. 1782.1; Kielsen, F. C. 1836.1; Lacépède, B. G. 1819.1; Richardson, J. 1843.2; Reichenbach, A. B. 1838.1; Rosenthal, F. 1812.1; Schmidt, K. 1820.1; Strack, — 1819.1; Swainson, W. 1820.1; Wagner, R. 1841.1; Anon. 503. — *Plates from Cuvier's "Animal Kingdom."* Comte, J. A. 1832.1; Guérin-Méneville, F. E. 1830.1.

Early illustrations of fishes. *Early figures of Hippocampus and Remora.* Eastman, C. R. 1915.3, Add. 1916.2, 3, 1917.4; Osburn, R. C. 1915.1. — *Figures of Ninth to Eleventh Centuries.* Merton, A. 1912.1. — *Animal drawings in Middle Ages.* Miller, C. 1897.1.

Pre-Linn. refs. to early figures. Albin, E. 1735.1; Collaert, A. 1580.1; Firens, P. 1616.1; Edwards, G. Pre-Linn. 1743.1; Flamen, A. B. 1664.1; Gesner, C. 1560.1;

Meyer, J. D. 1748.1; Stradanus, J. 1578.1; Tempesta, A. 1600.1; Willughby, F. 1685.1.

Plates of Biblical fishes. — Pre-Linn. section. C., A. 1756.1; Scheuchzer, J. J. 1731.1.

Atlases, Wall Charts, etc.

Biological and zoological charts. Burmeister, H. C. 1860.1; Fitzinger, L. 1864.1; Howes, G. B. 1885.1; Keibel, F. 1909.1; Leuckart, C. & Nitsche, H. 1877.1; M'Alpine, D. 1881.1; M'Alpine, D. & M'Alpine, A. N. 1880.1; Marshall, W. A. 1898.2; Schmeil, O. 1905.1.

Zittel's "Wandtafeln." Fossil Selachians and Ganoids. Pompeckj, J. F. 1900.1; Zittel, K. A. 1900.1.

Austrian and German fishes. Redlefgmal, E. 1909.1; Schreiber, — 1913.1; Anon 386.

Fishing scenes. Refs. in Pre-Linn. section. Barlow, F. 1671.1; Bol, J. 1600.1; Coenen, A. 1577.1; Cornelius, G. 1662.1; Laan, A. 1700.1; Lonicer, J. A. 1582.1; Meulen, S. 1700.1.

Fishes of specific regions

Asia. — *Illustrations of Indian zoology.* Gray, J. E. 1830.1. — *Collections of Chinese fish paintings by native artists.* Reeves, J. 1828.1; Anon. 135. — *Japanese fishes.* Anon. 742. — *"Dorades de la Chine."* Martinet, F. N. Add. 1780.1.

European fishes — from Austria and Germany. Redlefgmal, E. 1909.1; Meidinger, C. 1785.1; Weber, J. C. 1851.1; Anon. 771; Baldner, L. Pre-Linn. 1666.1. — *British fishes.* Whymper, C. 1897.1; Haeckel, A. Pre-Linn. 1734.1. — *Scandinavian.* Kroyer, H. N. 1847.1. — *Italian fishes.* Salviani, H. Pre-Linn. 1554.1.

North American fishes. Agassiz, L. & Baird, S. F. 1889.1; Kilbourne, S. & Goode, G. Add. 1879.1.

South American fishes, chiefly Brazilian. Wallace, A. R. (n. d.) (*Rio Negro*). — Pre-Linn. section. Marcgrave, G. 1643.1; Mentzel, C. 1660.1; Post, F. 1643.1. — *Commentaries on Marcgrave's figures of Brazilian fishes.* Lichtenstein, M. H. 1818.1; Martius, C. F. 1853.1; Schneider, J. G. 1786.1.

South Sea fishes. — *Fishes collected by J. Banks.* Broussonet, P. Add. 1782.1. — *Sketches made during Capt. James Cook's third voyage.* Ellis, W. W. Add. 1776.1.

East Indian Fishes. Pre-Linn. refs., Bruyn, C. 1718.1; Renard, L. 1718.1; Hooze, R. 1680.1; Anon. 773.

West Indian fishes. Pre-Linn. section. Catesby, M. 1750.1; Gautier d'Agoty, J. 1752.1; Hooze, R. 1680.1; Plumier, C. 1695.1. — *Identification of Catesby's figures.* Jordan, D. S. 1885.4.

INTEGUMENT OR SKIN (OFFISHES)

Although the integument properly includes the denticles and bony scales formed within the dermis, for the sake of convenience, the present section is limited to the soft tissues of the integument. The hard parts are treated under the heading "Dermal skeleton."

Likewise references to certain structures derived from the epidermis will be found elsewhere, such as Phosphorescent organs under Luminosity, and Poison glands under Poisonous fishes.

The integument in fishes, as in all vertebrates, consists of two layers, an outer *epidermis* (Oberhaut) consisting of the modified ectoderm, and an inner *dermis* or *corium* (Cutis vera, Lederhaut) composed of the outer or superficial layer of the mesenchyme which is modified mesoderm.

The dermis in fishes is thin and presents few distinctive features. It has in consequence not been the subject of extensive study. While many of the following references include the structure of the dermis, in general they refer chiefly to the epidermis.

Skin in general

Miscellaneous papers on the skin of Teleosts. Batelli, A. 1880.1; Leydig, F. 1851.1; Rathke, M. H. 1847.1.

Papers relating to the structure of the skin in the following Teleosts. — *Muraena*. Clark, A. 1849.1. — *Malapterurus*. Fritsch, G. T. 1886.1. — *Cyprinus*. Grunelius, A. 1913.1. — *Lophius*. Guitel, F. 1890.2. — *Cyclopterus*. Hase, A. 1911.2. — *Xiphias*. Nardo, G. D. 1841.2. — *Salmo*. Sacchi, M. 1887.1. — *Orthogoriscus*. Turner, W. 1862.1. — *Synodontis*. Vaillant, L. L. & Pettit, A. 1898.1. — *Ameiurus*. Wright, R. R. 1884.1.

In the blind fish *Typhlogobius*, there is "a highly abnormal development of blood-vessels in the sub-epidermal portion of the integument" obscuring the pigment layer and giving the living fish a pink color. This condition is presumably for the purpose of cutaneous respiration. Ritter, W. E. 1893.1.

No true metamerism is shown in the skin, such resemblances are due to muscular stresses. Grosser, O. 1905.1.

Transplantation of patches of skin from the uncolored ventral surface to the colored dorsal surface and vice versa in *Nemachilus* show no changes in color of the transplanted area until later immigration of chromatophores from surrounding areas and resorption takes place. Sécerov, S. 1912.1.

The skin of *Anguilla*, like other glandular structures, undergoes an excitatory variation as a result of electrical, thermic, and mechanical stimulation. Reid, E. W. 1894.2; Reid, E. W. & Tolputt, A. G. 1894.4.

Cutaneous sensory papillae

In the blind fishes (*Amblyopsidae*), the lack of eyes is compensated by the great development, especially on the head, of the cutaneous sensory papillae. ★Eigenmann, C. H. 1909.2.

Although possessing eyes, the *Gobiidae* likewise possess an extraordinary development of such cutaneous papillae, whose arrangement is said by Sanzo to be of diagnostic value. ★Sanzo, L. 1911.1; Winther, G. P. 1874.4.

Nerve terminations in the epidermis. Fusari, R. 1901.1, 1907.1; Jobert, C. & Grandey, — 1870.1; ★Merkel, F. 1880.1; Retzius, M. G. 1892.4,5; Schöler, E. 1885.1; Schulze, F. E. 1892.1.

For the epidermal sense organs (*Hautsinnesorgane*), see End organs under Senses and sense organs.

THE EPIDERMIS

The epidermis consists of two layers, a lower thick layer of actively dividing cells, the *stratum of Malpighi* and an outer layer of protective cells, the *stratum corneum*, which to replace wear is constantly renewed by division of the cells in the lower or Malpighian layer.

In various amphibians and reptiles this outer layer (periderm) is periodically shed as a whole but no such process occurs in fishes.

The most comprehensive general treatise (in German) on the epidermis, with a full bibliography is ★Studnicka, F. K. 1909.1.

Other older general treatises in German, are ★Leydig, F. 1879.1, and ★Maurer, F. 1895.1.

Probably the best summary in English of the literature on the epidermis of fishes is given in ★Reid, E. W. 1894.3.

Glandular elements

In correlation with their aquatic environment and in order to reduce surface friction by the secretion of mucus or "slime," the epidermis of fishes is generally rich in unicellular glandular structures.

Leydig (F. 1851.1), according to Reid (E. W. 1894.3), first demonstrated the possibility of a secretory process in the fish skin by the description of specialized cells in the epidermis of some twelve genera of fishes. To these cells he gave the general term "schleimzellen." Subsequent research has shown that several varieties were included under this general term.

"Kolben" or club cells

The first of the elements subsequently delimited was the "Kolben" cell or "Kolbenförmige Gebilde" of Max Schultze (1861.2) of the epidermis in *Petromyzon*. By F. E. Schulze (Add. 1867.1) the "kolben" cells were shown to occur also in *Tinca*, *Leuciscus*, *Cobitis*, *Anguilla*, *Esox*, and *Silurus*, and by Fritsch (G. T. 1886.1) in *Malapterurus*. These are the club cells of authors ("clavate" cells of Wright, R. R. 1884.1, p. 254). Schultze thought the "kolben" cells to be of the nature of nervous end organs and possibly contractile, because of certain appearances in polarized light, resembling those of striated muscle fibre. Although this view has been upheld by Pogojeff (L. 1889.1), nearly all subsequent workers have agreed on their secretory nature. Föttinger (A. 1876.1) followed their actual extrusion. The careful experimental work of Reid (E. W. 1894.3) on *Anguilla*, clearly demonstrates that the "club" cells produce the fine granules in the slime and also the threads, which are homologous with and resemble the threads in the slime of *Myxine* but are of finer texture.

The most comprehensive treatise on the "Kolben" cells, with a table showing the fishes in which they occur or are absent is ★Oxner, M. 1905.1.

"Becherzellen" or goblet cells

The second form of secretory cell is the goblet or *Becherzell*. Although known as the

Integument — Cont'd.

"Vesicula limpida" of the intestinal epithelium by Henle as early as 1837, the "Becherzellen" were first adequately described by Schulze (F. E. Add. 1867.1). The name "Becherzellen" was first applied by this author in the "Centralbl. f. med. Wiss.," no. 11, 1866. These cells occur in the epidermis of fishes and amphibians, the intestinal epithelium of all vertebrates, and in the "respiratory canal" of lung breathers. The "Becherzellen" receive adequate treatment (bibliographic, historical, etc.) by J. H. List in the Arch. f. mikr. Anat., 1886, vol. 27, pp. 481-588, 6 pls.

According to the researches of Reid (E. W. 1894.3), the goblet cells supply the mucin and after reaching the surface and discharging their load, they are capable of undergoing regeneration.

The club cells, the goblet cells, and the ordinary epidermic cells, are descendants of the palisade cells of the basal layer of the epidermis.

Papers specifically relating to the goblet cells are List, J. H. 1885.1-3; Helly, K. 1905.1; Oedmannson, - 1863.1; Oeffinger, H. 1867.1.

Epidermis in general

The following papers in general refer to the histological structure of the epidermis including the club and goblet cells and other epidermal elements.

Epidermis of Petromyzon. ★Fœttinger, A. 1876.1; ★Kapelikin, V. 1897.1; Kölliker, R. A. 1860.6; Leuckart, C. G. 1856.1; Loewenthal, N. 1904.1; Marengi, G. 1903.1; Müller, H. 1864.1,2; Pogojeff, L. 1889.1; Razzauti, A. 1911.1, 1912.1; Schultze, M. J. 1861.2; ★Schulze, F. E. 1863.1, Add. 1867.1; Studnička, F. K. 1909.1.

Structure of the epidermis in Protopterus. Kölliker, R. A. 1860.1; Paulson, O. M. 1865.1.

Structure of the epidermis in the following Teleosts. — *Salmo fario.* Ebner, V. 1886.1. — *Trachypterus.* Kaschkaroff, D. 1913.1. — *Anguilla.* Lengerken, H. 1913.1; Reid, E. W. 1894.2,3. — *Teleosts.* Nusbaum, J. & Kulczycki, W. 1906.1,2. — *Schizothorax and Capeta.* Pavlovskii, E. 1910.1, 1911.2. — *Siluridae.* Rauther, M. 1907.1.

Thread cells of Myxine

The hagfish or "slime eel," *Myxine glutinosa*, derived its specific name from its well known habit of exuding enormous quantities of mucus. According to Blomfield (J. E. 1882.1), "two individuals thrown into a bucket of water are capable of gelatinising the whole with their secretion."

This secretion, according to Reid (E. W. 1893.1), is derived from a double row of glands (schleimsäcke of Müller), which are virtually simple involutions of the skin (epidermal inpushings into the dermis), extending along the belly of the animal from head to tail. Each gland has a separate duct to the surface. These structures were first described by Retzius (A. J. 1824.1) but more accurately by Müller (J. 1834.1, v).

The secretion, before its dilution with water, possesses a milky appearance due to the presence of large numbers of cells, whose protoplasm has been converted into a single complexly wound thread which, after exudation, readily unwinds and adds to the viscosity.

These cells, called "Fadenkörper" by Müller, were independently termed "thread cells" by Blomfield. They are apparently specialized forms of the "Kolben" cells, described above, and develop in the epidermal lining of the gland.

Papers relating to the epidermis of Myxine with the thread cells, mucous glands, etc. Blomfield, J. E. 1882.1; Kölliker, R. A. 1860.6; and Retzius, M. G. 1905.1.

Chemical examination of the mucous secretions of Myxine shows granules presenting most of the features of a mucin, but which do not yield a body reducing Fehling's solution. ★Reid, E. W. 1893.1, 1894.1.

Bdellostoma also encloses itself in a transparent, gelatinous mass having the consistency of thick egg albumen. Ayers, H. 1894.1.

Cornifications of epidermis

In general the epidermis of fishes is soft and cornifications of it are comparatively rare.

Among such cornifications are the "pearl organs," small tubercles appearing chiefly on the head of various Cyprinidae, at breeding time. Leydig, F. 1892.2; Reighard, J. 1903.2, 1904.1, 1910.2.

Similar "contact organs" found on the scales or fins of the males of some Pæciliidae at the breeding season, are not purely epidermal but possess an osseous or dermal core. Newman, H. H. 1907.1, 1909.1.

The "teeth" of the Cyclostomata (lampreys) are cornified epidermal structures. For references, see under Dentition.

Deckplatte. In some embryonic Anamnia, Petromyzon and Amphibia, the outer layer of ectoderm cells may, for a time, be ciliated. The cilia however disappear upon the hardening of the superficial protoplasm of the cells of the stratum corneum to form a so-called cuticula. By Studnička (F. K. 1897.5) this striated cuticular structure is termed "Deckplatte."

In *Lepadogaster*, the epidermis of the adhesive disk forms a thick cuticular plate. Guitel, F. 1888.1; Studnička, F. K. 1906.1, 1909.1.

THE ARGENTEUM

Underlying the dermis or corium of fishes is a layer of connective tissue, the tela subcutanea.

In many fishes, this layer contains numerous crystals of guanin which form a reflecting layer composing the argenteum which produces the silvery coloration.

According to Ewald and Krukenberg (1883.1), quoted from Cunningham and MacMunn (1893.1, p. 782), "the guanin is contained in connective tissue cells, in some cases in fine crystalline plates as a lime compound (guaninkalk) (Teleostei, Ganoidei, Cyclostomata), in others in the pure condition, and then it is only dead white, and has no metallic lustre (skin of Selachians)." The presence of guanin likewise frequently gives a silvery appearance to the peritoneum and the air bladder. "The beautiful metallic appearance of the iris in fishes is due to crystals of guanin."

The discovery of the true nature of the guanin is due to Barreswil (Add. 1861.1) who upon making a chemical examination of the "blanc d'ablette" or silvery substance extracted from the skin of the bleak (*Alburnus*) and used in the manufacture of artificial pearls, decided that this material was identical with

the "guanin" isolated by Bodo Unger from guano in 1845. A short time later Voit (C. 1865.1) independently reached the same conclusion.

Early investigations on the nature of the silver substance. Goebel, F. 1836.1; Schnitzlein, A. 1836.1, Add. 1837.1; Wittich, W. H. 1854.1.

Distribution of guanin in the skin of fishes. Bethe, A. 1895.1; ★Cunningham, J. T. & MacMunn, C. 1893.1; ★Ewald, A. & Krukenberg, C. F. 1882.1, 1883.1; Prince, E. E. 1893.2; MacMunn, C. A. Add. 1895.1.

For the use of guanin in making artificial pearls, see this heading below Economic products under Fisheries.

For references to the "biological significance of silvery coloration," see Miscellanea under Coloration.

LATERAL LINE SYSTEM

For related structures, see under Senses and sense organs; Tactile organs; etc.

General treatises. Sède de Lieoux, P. (Teleosts) 1884.1; Leydig, F. Add. 1868.1.

Development. Earliest anlage. Mitrofanov, P. I. 1889.1; Wilson, H. V. & Mattocks, J. E. 1897.1; Krause, W. Add. 1906.1. — *Amia*. Beckwith, C. J. 1902.1, 1907.1. — *Torpedo*. Coggi, A. 1902.2. — *Selachii*. Klinkhardt, W. 1905.1. — *Lepidosteus*. Landacre, F. L. & Conger, A. C. 1913.1.

Histology. Solger, B. F. 1880.2. — *Cupula terminalis*. 1887.1. — *Macruridae*. ★Pfüller, A. 1914.1.

Innervation (by branches of the lateralis nerve). Burne, R. H. 1901.1; Leydig, F. 1850.2, 1851.2; Schulze, F. E. 1861.1.

Physiology, or functions, of the lateral line system. Bonnier, P. 1896.1; Knox, R. 1825.1, 2, 1827.1; Lee, F. S. 1898.1; ★Parker, G. H. 1904.1, 2, 1905.1; Stahr, H. 1897.1. — *Selachii*. Fuchs, S. 1895.1, 2. — *Macruridae*. ★Pfüller, A. 1914.1. — *Cyprinus*. Richard, J. 1896.1.

Structure of the lateral line system.

Miscellaneous and general. Agassiz, J. L. 1848.6; Beard, J. 1884.1, 1885.1; Der-cum, F. 1880.1; Dunn, M. 1895.1, 1901.1; Marsson, M. 1897.2; Sappey, M. P. 1880.1, 2; Vogt, C. C. 1856.1. — *Fossil fishes*. Collinge, W. E. 1893.2; Woodward, A. S. 1887.7. — *Earliest reference*. Rivinus, A. Q. Pre-Linn. 1687.1.

Larger researches. ★Allis, E. P. 1904.1; ★Heilig, K. 1912.1; ★Hofer, B. 1908.1; Hyrtl, C. J. 1843.1; Macdonnell, R. 1864.1; Pell, M. 1907.1; Schulze, F. E. 1870.1, 1871.1.

Structure of lateral line system in various fishes. — *Ammocætes*. Leuckart, C. G. 1856.1.

Elasmobranchii. Ewart, J. C. & Mitchell, J. C. 1895.1; Fritsch, G. T. 1888.1; Garman, S. 1888.1; Robin, C. P. 1846.5; Solger, B. F. 1880.1; Todaro, F. 1870.1. — *Mustelus*. Allis, E. P. 1901.1. — *Spinax*. Brohmer, P. 1908.2; Rund, G. Add. 1914.1. — *Torpedo*. Coggi, A. 1891.3;

Fritsch, G. T. 1894.2; Müller, H. 1852.1. — *Chimæra*. Cole, F. J. 1896.1, 2; Collinge, W. E. 1895.2; Reese, A. M. 1910.1; Solger, B. F. 1880.1. — *Squaloraja*. Woodward, A. S. 1887.2.

Ganoidei. — *Amia*. Allis, E. P. 1888.1. — *Polypterus*. Allis, E. P. 1900.1; Baur, G. H. 1896.1; Collinge, W. E. 1893.3, 1896.1. — *Polyodon*. Allis, E. P. 1903.3; Nachtrieb, H. F. 1902.1–1912.1. — *Acipenser*. Baer, K. E. 1826.1; Jaquet, M. 1899.2. — *Lepidosteus*. Collinge, W. E. 1893.1. — *Ganoidei*. Collinge, W. E. 1894.1, 1895.5; Kingsbury, B. F. 1896.1.

Teleostei. Dantan, L. 1906.1; Leydig, F. 1850.1; Solger, B. F. 1878.2, 1880.1, 1882.2, Add. 1877.2. — *Muraenidae*. Allis, E. P. 1903.1. — *Cottus*. Bodenstein, E. 1883.1. — *Siluridae*, chiefly *Ameiurus*. Bunker, F. S. 1897.1; Fritsch, G. T. (*Malopterurus*) 1886.1; Herrick, C. J. 1901.1; Pollard, H. B. 1892.1; Wright, R. R. 1884.1. — *Batrachus*. Clapp, C. M. 1899.1; Jordan, D. S. 1900.2. — *Icosteus*. Cohn, L. 1906.1. — *Gadus*. Cole, F. J. 1898.1. — *Physostomi*. Collinge, W. E. 1895.4. — *Mugil*. Fée, F. 1869.1. — *Lepadogaster*. Guitel, F. 1887.2. — *Cyclopterus*. 1889.1. — *Lophius*. 1890.1, 1890.2, 1891.1. — *Lota*. Hyrtl, C. J. 1866.1. — *Clupea*. Ryder, J. A. 1890.3. — *Percoids*. Steindachner, F. 1862.1 (ii).

SENSORY ORGANS

Which are closely associated with the lateral line

Ampullæ of Lorenzini, mucous canals or subcutaneous pit-organs found on lateral and dorsal surfaces of the heads of Elasmobranchs.

Morphology, development, etc. Boll, F. 1868.1; ★Coggi, A. 1891.2, 1902.1, 2, 1905.1; Brohmer, P. 1908.2; Forssell, G. 1894.1; Johnston, J. B. 1902.5; ★Minckert, W. 1901.1; Peabody, J. E. 1897.1; Retzius, M. G. 1898.3; Rund, G. Add. 1914.1.

As organs for pressure perception. Metcalf, H. E. 1915.1.

Ampullary canals in Chimæra. Cole, F. J. 1896.2; Collinge, W. E. 1895.2.

Ampullæ of Savi (Savi's vesicle), of the ventral surface of the head of Torpedo.

Anatomy. ★Boll, F. 1875.1; Coggi, A. 1891.3; Fritsch, G. T. 1894.2; Garman, S. 1892.4; Kölliker, R. A. 1857.4.

LIVER (INCLUDING GALL BLADDER)

For associated structures, see Intestine and Stomach under Alimentary Tract, also Pancreas and Spleen.

For the occurrence of glycogen in the liver, and for the role of the fat content of the liver of sharks, see under Chemistry.

For urea formation in the liver, see Excretion under Physiology.

Anatomy and morphology, general accounts. Guillot, N. 1846.1, 1848.1; Jones, H. 1854.1; Mierendorff, F. W. 1817.1; Rathke, M. H. 1826.1, 4, 1837.2; Weber, E. H. 1827.8; Schmid, F. C. Add. 1882.1; Shore, T. W. & Jones, H. L. Add. 1889.1.

Liver — *Cont'd.*

— *Glandular structure.* Retzius, M. G. 1892.6.

Anatomy of liver in various fishes. — *Ammocætes and Petromyzon.* Dervieux, L. 1898.1; Kuliabko, A. A. 1898.1. — *Ameiurus.* Macallum, A. B. 1884.1. — *Callionymus.* Pilliet, A. H. 1889.1. — *Selachii.* Pilliet, A. H. 1890.2. — *Teleosts.* Segerstråle, E. 1910.1. — *Clarias.* Weber, M. C. 1891.1.

Development, general papers. ★Choronshitsky, B. 1900.1; Piper, H. 1902.1, 2, 3.

Development in various fishes and groups of fishes. — *Ammocætes.* Brachet, A. 1897.1. — *Elasmobranchii.* Brachet, A. 1896.1; Hammar, J. A. 1893.1, 1897.1; Scammon, R. E. 1913.1. — *Dipnoi.* Broman, I. 1905.1; Neumayer, L. (*Ceratodus*) 1904.1, 3. — *Amphioxus.* Hammar, J. A. 1898.1. — *Acipenser.* Nicolas, A. 1904.1. — *Trout.* Stöhr, P. A. 1893.1; Stricker, F. 1899.1.

Histology. Holm, J. F. 1897.1; ★Oppel, A. Add. 1900.1. — *Acipenser and Ceratodus.* Bluntschli, H. 1903.1, 1904.1. — *Selachii.* Scammon, R. E. 1915.1. — *Amphioxus.* Zarnik, B. 1905.1.

Gall bladder. — *Anatomy.* Cabibbe, G. 1903.1. — *Development.* ★Choronshitsky, B. 1900.1. — *Development, Elasmobranchs.* Scammon, R. E. 1913.1. — *Biliary calculi in squeteague.* Tower, R. W. 1902.1.

Bile ducts. — *Ductus cysticus, structure.* Hyrtl, C. J. 1868.1. — *Liver ducts, development.* Scammon, R. E. 1913.1.

For the chemical composition of bile, see under Chemistry.

LOCOMOTION

For the organs of locomotion, see Fins.

For the flight of fishes, see Flying-fishes.

For the hydrostatic functions of the swim-bladder, see under Air bladder.

For the maintenance of equilibrium, see under Hearing and the static sense.

For a comprehensive review in German of all technical researches on locomotion, see ★Du Bois-Reymond, R. Add. 1914.1.

For a popular treatise in English on all kinds of locomotion in animals including fishes, see ★Pettigrew, J. B. Add. 1883.1.

Miscellaneous items, not readily classifiable. — *Relation of number of myotomes to bodily rigidity.* Magnan, A. & La Riboisière, J. 1912.1. — *Methods of fixation against strong currents by means of spines.* Thilo, O. 1900.1, 1903.1. — *Influence of high pressures on muscular contraction.* Regnard, P. 1887.1. — *Demonstration of steering mechanism of fishes.* Völker, H. 1911.1.

Experimental researches

Effects on locomotion, of the extirpation or section of various parts of the central nervous system. Bethe, A. 1899.1; Polimanti, O. 1911.3, 5, 1913.1; Rynberk, G. A. 1905.5, 1906.4, Add. 1904.1; Corblin, H. Add. 1888.1.

Experiments in removing different fins; caudal considered chief locomotor organ of sharks. Mayer, P. 1886.1. — *Similar exps. with teleosts.* Monoyer, F. 1866.1, 2. — *Similar experiments with the cyprinodont, Goodea.* Dugès, A. 1905.1, 2. — *Comment on Dugès.* Osburn, R. C. 1906.1.

Swimming in fishes

General accounts. Text in — *Dutch.* Brugmans, S. J. 1812.1; Winkler, T. C. 1860.3. — *French.* Amans, P. C. 1887.1, 1888.1; Chevrel, R. 1913.1; Giraud-Teulon, M. A. 1856.1, Add. 1858.1. — *German.* Bickel, A. 1896.1; Meier, H. 1860.1; Thilo, O. 1901.1. — *Italian.* Ducceschi, V. Add. 1903.1.

Miscellaneous and relatively unimportant papers. Text in English. Bennett, E. F. 1899.1; Buckland, W. 1844.1; ★Kent, W. S. 1873.1, 1874.3; Nichols, J. T. 1912.7; Wilder, B. G. 1870.1.

Miscellaneous papers in German. Ahlers, C. 1900.1; Brehm, A. E. 1871.1; Kathariner, L. 1899.1; Schlesinger, G. 1911.2; Anon. 175, 609, 610.

Miscellaneous papers with text in — *French.* Corblin, H. 1887.1, Add. 1888.1; Gouriet, E. 1864.1. — *Italian.* Dei, A. 1896.1. — *Dutch.* Harting, P. 1873.3. — *Norwegian.* Kent, W. S. 1874.2. — *Finnish.* Regnard, P. 1893.3. — *Polish.* Staff, F. 1911.1.

TYPES OF SWIMMING

Borelli's theory; that in swimming, the tail vibrates on either side of a given line which corresponds to the axis of the fish when the body is straight. This is the axis of motion; the tail acts as a rudder. Borelli, G. A. Pre-Linn. 1680.1. — *Remarks on Borelli.* Winslow, J. B. Pre-Linn. 1738.1.

Undulating, wriggling, or eel-like locomotion and related types. Schlesinger, G. 1911.1, 3; ★Strasser, H. 1882.1, 1883.1.

Progression of sharks by undulation or the swaying from side to side of the unsymmetrical caudal fin and the whole posterior part of the body. Ahlhorn, C. G. 1895.2; Polimanti, O. 1911.3.

Screw propeller action of single median dorsal fin rapidly vibrating from end to end in pipefishes, Syngnathidae. — *Hippocampus.* Anthony, R. & Chevroton, L. 1913.1; Ishihava, M. 1905.1. — *Syngnathus.* Weinland, D. F. 1856.2.

Progression by vibration of the elongated median anal fin of Notopteridae. Schlesinger, G. 1910.3.

Swimming with tail and walking on bottom with dactyliiform rays of the pectorals, Trigla. Chabry, L. 1883.1; Deslongchamps, J. A. 1843.1; Polimanti, O. 1911.3. — *Prionotus,* Allen, H. 1886.1.

Observations on the vertical swimming position of Amphisile strigata. Willey, A. Add. 1902.1.

Unusual types of locomotion

Climbing habits and overland progression of the "climbing-perch," Anabas scandens. Daldorff, D. C. 1797.1; Mitchell, J.

1864.1; Neill, B. A. 1864.1; Zur Mühlen, M. 1911.22; Layard, E. L. Add. 1853.1.

Climbing of the Andean catfish, Arges marmoratus. Johnson, R. D. 1912.1, Add. 1913.1.

Ichthyopatolites or petrified track-wings of ambulatory fishes. Buckland, W. 1843.1.

Leaping habits of marine fishes, ascent of water-falls, etc. Clapham, T. 1879.2; Dumesnil, A. 1906.1; Holder, C. F. 1903.3; Smith, Everett 1879.1.

Lampreys ascending water-falls. Smith, H. M. 1900.3, 1902.6.

Overland progression or terrestrial locomotion of. —Doras and Callichthys. Allen, G. 1885.1; Hancock, J. 1828.1.

—Gobiesox, found 40 feet from water. Pickering, C. 1862.1. *—Xenomystus.* Schlesinger, G. 1912.2. *—Clarias.* Vaillant, L. L. 1895.3, 1896.3. *—Unnamed fishes.* Anon. 619; Gostling, D. Add. 1894.1.

Overland migrations of the eel, Anguilla. Danner, H. 1880.1; Lengerke, — 1876.1; Lindes, L. 1880.12; Schreitmüller, W. 1914.11; Anon. 3, 254.

Terrestrial progression of Periophthalmus by hopping in mud. Allen, G. 1885.1; ★Johnstone, J. 1903.2; Martens, E. 1881.1; Pickering, C. 1862.1.

Terrestrial locomotion of Gasterosteus. Gergens, — 1862.1.

LUMINOSITY AND PHOSPHORESCENCE (OF FISHES)

Comprising the production of light by means of specialized photogenic organs, which occur chiefly in the deep-sea fishes.

Miscellaneous observations, notes, popular accounts, etc., on the luminosity or phosphorescence of fishes, luminous fishes, phosphorescent organs, etc.

Text in English. Bell, F. J. 1881.1; Hall, J. J. 1872.1; Franklin, C. L. 1900.1; Kent, W. S. 1873.4; ★McIntosh, W. C. 1885.3, 1906.3; Nicols, A. 1872.1; Nutting, C. C. 1899.2; Shufeldt, R. W. 1894.1, 1907.1; Weber, M. C. 1901.1.

Text in French. Deslongchamps, J. A. 1838.1; Gadeau de Kerville, H. 1890.1; Khvorostansky, C. 1892.1; Mulder, E. 1861.1.

Text in German. Dittrich, R. 1888.1; Doflein, F. J. 1906.3; Frisch, K. 1909.1; Gadeau de Kerville, H. 1893.1; Haupt, H. 1903.1; Marenzeller, E. 1889.1; Pütter, A. 1905.1; Radziszewski, B. 1880.1; Schenkling-Prévôt, — 1902.1; Schneider, G. 1904.9; Stenta, M. 1905.1; Thilo, O. 1910.2; Zugmayer, E. 1910.2; Anon. 338.

Text in — Italian. Giglioli, E. H. 1870.1. *— Dutch.* Harting, P. 1866.5; Mulder, E. 1859.1; Anon. 602. *— Swedish.* Lönnberg, A. J. 1904.1. *— Latin.* La Faille, J. M. Add. 1821.1.

LIGHT PRODUCTION

Physiology of luminescence

For a scholarly treatise on light production in all groups of animals including fishes,

with a full bibliography, see ★Mangold, E. Add. 1910.1.

An excellent recent physico-chemical treatise, including all groups of light-producing organisms, is ★"The nature of animal light" by E. Newton Harvey. Philadelphia and London (Monographs on experimental biology), 1920, 182 pp., 35 figs.

Physical base of animal phosphorescence. Watase, S. 1895.1.

Three-day old specimens of Ehippus (surface fishes without luminous organs) were very decidedly phosphorescent at night when sudden impulses were imparted to the water. Ryder, J. A. 1880.1.

Observations on the emission of light by living fishes. Our belief in the existence of luminous organs in fishes is based on their comparative structure and the following few actual observations on living fishes.

For a résumé of all such observations, including a few additional to those given below, see ★Brauer, A. 1908.2 (pp. 127–133). These are repeated in Mangold, E. 1907.1 and 1910.1.

First notice of light emission in fishes. Astronesthes fieldii, observed during a voyage to Brazil, "sent forth two strong and vivid greenish lights, which intermitted momentarily, and ceased altogether when the fish died." Reinhardt, J. T. 1853.1, 1854.1. *— Astronesthes observed also by Vanhöffen,* E. 1901.1.

Luminosity of post-orbital organ of Melanostomias melanops seen during Valdivia Expedition. Brauer, A. 1908.2 (p. 87).

Porichthys, placed in an aquarium made alkaline with ammonia water, exhibited a brilliant white light for about twenty minutes. Greene, C. W. 1899.1.

A nearly dead specimen of Scopelus boops dredged off the Cape of Good Hope, "displayed a faint though an undoubted luminosity . . . in the pectoral region." Guppy, H. B. 1882.1.

Maurolicus pennantii observed in the Naples aquarium. Mangold, E. 1907.1.

Among coral reefs of Malay peninsula, Steche observed a continuous glow in Photoblepharon and intermittent flashes in Anomalops. Steche, O. 1907.1, 1909.1.

Sternoptyx, brought up in the trawl at night in the North Pacific, glowed like a luminous star. Willemoes-Suhm, R. 1875.1.

Isistius brasiliensis, a spinacid shark, captured in Australian seas, was placed in an aquarium and remained aglow for about three hours. Bennett, F. D. 1840.1.

Spinax niger in a darkened room at the Naples aquarium, glowed "with a feebly shining greenish lustre." Note by Th. Beer in Johann, L. 1899.1. *— "Spectral colors" of Spinax at Naples, visible even in daylight.* Burckhardt, C. R. 1900.2.

PHOSPHORESCENT ORGANS

Photophores or radiating organs

The nature of these organs was originally disputed and they were termed

Luminosity — Cont'd.

"accessory eyes" by Usov, and "eye-like pigment spots" by Leydig. By these authors and others they have been called "accessorische Augen," "augenähnliche Flecken," "Nebenaugen," "Pseudo-äugen," oculiform organs, pearly organs, etc.

Luminous organs are recorded from fishes belonging to 69 genera and 239 species by ★Brauer, A. 1908.2.

General treatises

Structure of the phosphorescent organs.

Text in English. ★Lendenfeld, R. 1887.2, 1905.1.

Text in German. ★Brauer, A. 1904.4-1908.2; Lendenfeld, R. 1887.1, 1891.1; Leydig, F. 1881.1; Solger, B. F. 1881.1; Trojan, E. 1906.2.

Text in Italian. Chiarini, P. 1900.1; Chiarini, P. & Gatti, M. 1899.1; Gatti, M. A. 1899.1, 1904.1.

Structure in various fishes**SELACHII**

All Selachians which possess luminous bodies are pelagic and belong to the family *Spinacidæ* (including *Lamargus*). ★Burckhardt, C. R. 1900.2; Johann, L. 1899.1; — *Selachii* generally. Leydig, F. 1909.1; Ohshima, H. 1910.1, 1911.1.

TELEOSTEI

Various general papers. Brauer, A. 1904.4, 1905.1; Chun, C. 1893.1; Guerne, J. 1880.1; ★Usov, M. M. 1879.1, 1880.1.

Structure of the phosphorescent organs in — *Lamprotopus*. Boulenger, C. L. 1913.1. — *Argyropelecus*. Brandes, G. 1899.1; ★Handrick, K. 1901.1. — *Chauliodus*. Brandes, G. 1899.1; Lereboullet, D. A. 1864.4; Leydig, F. 1879.2; Leuckart, R. 1865.1, 1866.1. — *Anomalops*. Dahlgren, U. 1908.1. — *Anomalops* and *Photoblepharon*. ★Steche, O. 1907.1, 1909.1; Weber, M. 1901.2, 1913.1. — *Porichthys*. Eigenmann, C. H. & Eigenmann, R. S. 1889.7; ★Greene, C. W. 1899.1. — *Scopelus*. Emery, C. 1884.1, 1888.1, 1890.1. — *Maurolicus*. Groot, G. J. 1908.1. — *Ipnops*. Moseley, H. N. 1887.1. — *Myctophidæ* and *Sternoptychidæ*. Ohshima, H. 1910.1, 1911.1. — *Gonostoma* (young). Sanzo, L. 1912.1. — *Cyclothone*. ★Trojan, E. 1915.1. — *Heterophthalmus*. Vorderman, A. G. 1900.1.

PHOSPHORESCENCE OF DEAD FISH

This phosphorescence, appearing in both marine and fresh-water fish, meat, vegetable matter, etc., is caused by photogenic bacteria, especially *Bacterium phosphoreum*. (Cohn.)

For a full discussion of the subject, see ★Mangold, E. Add. 1910.1. See also Barnard, J. E. in Jenner Instit. Prev. Med., 2nd ser. Aug. 1899, pp. 81-112.

Various papers, chiefly speculations on the causes of the phosphorescence. (True nature not recognized before Pflüger's suggestion.) Matteucci, C. 1848.1; ★Pflüger,

E. F. 1875.2; Phipson, T. L. 1860.1; Hulme, N. Add. 1800.1; Martin, A. R. Add. 1761.1, 2, 1765.1; Beal, J. Pre-Linn. 1666.1.

Recording luminous fat in *Trachypterus*, doubtless a bacterial luminescence. Panceri, P. 1871.1, 1872.1. — Review of this. Baird, S. F. 1871.33.

Early experiments. Boyle noticed decrease of phosphorescence when a vacuum was created. Boyle, R. Pre-Linn. 1667.1, 1670.2.

MEDICAL PROPERTIES (ALLEGED, OF FISHES).

For a valuable recent work in English, with a discussion of the use of fishes by the Greeks and Romans as prophylactic and curative agents in rabies, toothache, pregnancy, etc., see ★Wm. Radcliffe. "Fishing from the earliest times." London. 1921. 478 p. ill.

Purgative effects of oil of *Ruvettus*, "purge-fish" of South Seas. Krämer, A. 1901.1; Waite, E. R. 1899.1.

Use of electrical fishes as shock machines. — Alleged use of electrical eel in Surinam. Lott, F. 1762.1; Wilson, G. 1857.1, 1860.1. — *Torpedo* used. Frenzel, J. S. Add. 1777.1; Kaempfer, E. Pre-Linn. 1694.1.

Use of fishes in the medical practice of the 16th-18th centuries. Badham, C. D. 1854.1; Moquin-Tandon, C. 1860.1; Surbeck, G. 1901.2.

The following references will be found in the Pre-Linn. section.

Text respectively in French, Dutch, and Italian. Arnault, de N. & Salerne, F. 1756.1; Bontius, J. 1642.1; Matthioli, P. A. 1548.1.

Text in English. Keogh, J. 1739.1; Kiranus, 1685.1; Lovell, R. 1661.1; Mandeville, B. 1739.1; Schroeder, J. 1659.1.

Text in German. Bapst, M. 1590.1; Bock, H. 1539.1; Durante, C. 1585.1, 1593.1; Mercklein, G. A. 1696.1.

Text in Latin. Bossche, G. 1639.1; Cirino, A. 1653.1; Dale, S. 1693.1; ★Dioscorides, P. 1478.1; ★Galenus, C. 1490.1; Helmont, J. 1707.1; Koenig, E. 1682.1; Nonnius, L. 1627.1; ★Oribasius, 1555.1; Sidren, J. 1750.1; ★Xenocrates, 1559.1; Anon. 753.

Supposed medical virtues of — *Tench*. Camerarius, J. R. 1624.1, 1683.1. — *Mullet*. Marcellus Sidetes, 1705.1. — *Herring*. Neucrantz, P. 1654.1. — *Liver of eel*. Panarolli, D. 1654.1.

METAMERISM

For organs definitely metameric in structure, see Head; Myomeres under Myology; Medullary tube under Embryology; Skeleton; Skull; Vertebral column; and Visceral Skeleton.

For the extensive literature on the metamorphism of the head, see under Head.

In general, note papers of A. Dohrn whose researches (1876-1906) treat all aspects of this problem.

General papers on the metameric structure of the animal body. Ahlborn, C. G. 1884.2; Gaskell, W. H. 1898.1 (xi.); Hatschek, B. 1892.1,2; Schultze, O. 1896.1.

Metamerism of the embryonic central nervous system. ★Barbieri, C. 1909.1; ★Hawkes, O. A. 1905.2; Locy, W. A. 1894.1; McClure, C. F. 1897.1; Neal, H. V. (*Squalus*) 1896.1; Waters, B. H. 1891.1, 1892.1; Henneguy, L. F. Add. 1888.1.

Metamerism of the cranial nerves. Beard, J. 1885.2; Herrick, C. J. 1899.2; Ihering, H. 1878.1; Mitrofanov, P. I. 1892.2; ★Nicholls, G. E. 1915.1; Shore, T. W. 1889.1; Marshall, A. M. Add. 1882.1.

Metameric motor nerve plexuses. Braus, H. 1909.1; Goodrich, E. S. 1910.1.

Metamerism in the sympathetic nervous system. Rynberk, G. A. 1906.2. — *Segmental innervation of skin by sympathetic nervous system.* Rynberk, G. A. 1905.1, 1907.1.

Metameric structure of mesoderm and entoderm. — *Petromyzon.* Hatta, S. 1901.2. — *Head mesoderm, Amphioxus.* Hatschek, B. 1906.1–1910.1. — *Head mesoderm, Cyclostomes.* Neal, H. V. 1915.3. — *Entoderm and circulatory system of the trunk.* Houssay, F. 1891.1.

Metameric structure of the skin. — *Se-lachii.* Grosser, O. 1905.1; Rynberk, G. A. 1905.3, 1908.1.

Metamerism of the longitudinal muscles. Harrison, R. G. Add. 1894.1.

MIGRATIONS OF FISHES

Some of the anadromous fishes, i. e. those which spend the greater part of their life in the sea, such as the salmon, run up for several thousand miles, to the headwaters of rivers, in search of a suitable place to spawn. Others which grow to maturity in the fresh-water streams or lakes (catadromous fishes), like the eel, perform a migration of no lesser distance from the rivers of Europe and North America to depths off the West Indies, travelling also for the purpose of reproduction. Other marine fishes annually move northward and southward in pursuit of their food. Thus the subject of migrations is intimately related to that of their breeding and feeding habits and their life-histories, and cannot, in the case of *Anguilla*, *Pleuronectidæ*, and *Salmonidæ*, be readily treated separately. References to the migration of these fishes will therefore be found under the sections, *Anguilla*, *Pleuronectidæ*, and *Salmonidæ*, respectively.

The most recent and comprehensive work (in English) on "Migrations of Fishes" is ★Meek, A. 1916.1.

The various workers of the regional Fisheries Bureaus of the International Commission for the Investigation of the Sea have made the most detailed records and observations of the migrations of the principal North-Atlantic food fishes. Their papers have largely been published in the publications of the Commission, especially *Rapports et Procès-Verbaux*, and also *Publications de Circonstance of the Conseil Permanent International pour l'Exploration de la Mer*, Copenhagen; and *Meddelelser fra Kommissionen for Havundersøgelser*, Serie Fiskeri,

Copenhagen; and *Wissenschaftliche Meeresuntersuchungen der deutschen Meere in Kiel und der Biologischen Anstalt auf Helgoland*.

Other older, general treatises are: Berthelot, S. 1875.1; ★Goode, G. B. 1878.4; Homeyer, E. F. 1881.1; Roule, L. 1914.2; Serres, P. M. 1842.1; Woltereck, R. 1908.1.

Influences of currents, weather conditions, vulcanism, etc., on migrations. Armistead, J. J. 1894.1, Add. 1888.1; Krebs, W. 1911.2, 1912.1; Masterman, A. T. 1897.3; Nordgaard, O. 1910.1; Willis-Bund, J. W. 1887.1.

To define migrations which are intimately associated with currents, the terms contranant and denant are proposed by Meek, A. 1915.2.

Migrations in various localities

Notes on the appearance or migration of fishes in — *Sweden.* Aurivillius, C. W. 1899.1. — *Massachusetts.* Blake, J. H. 1870.1; Slade, E. 1883.1. — *Volga delta.* Deržavin, A. 1913.1; Tereschenko, K. K. 1912.1. — *Lake Geneva.* Chatelanat, H. 1874.1. — *Baltic Sea.* Franz, V. 1908.1; Strodtmann, S. 1906.1, 1911.1. — *Norway.* Helland, A. T. 1908.1. — *North Sea.* Henking, H. 1905.1. — *Venezuela.* Ernst, G. A. Add. 1886.1.

Records of the annual appearance of various tropical fishes, including sharks and rays, on the North Carolina coast. Coles, R. J. 1913.1.

Evidence of migrations in Belgium during the Palæozoic era. Lohest, M. 1888.2.

Migrations of various fishes

Additional data on migrations will probably also be found in the references to Natural History under the fishes referred to below.

Acipenser. Antipa, G. 1906.1; Nazarov, J. 1901.1.

Caspiomyzon (from Caspian Sea into the Volga). Pravdin, I. F. 1913.1.

Petromyzon. Anon. 621.

Teleostean fishes

Herring (Clupea harengus). Baird, S. F. 1878.5; Baženov, A. 1906.2; ★Broch, H. 1908.1,2; ★Cligny, A. 1912.9, Add. 1907.1, 1914.1; Gilpin, J. 1786.1; Goly-netz, W. 1907.1; Hinkelmann, A. 1902.1; Krebs, W. 1911.1; Kuznetzov, I. D. 1894.1; Lindahl, J. 1878.1; Mitchell, J. M. 1861.1; Morrison, W. D. 1829.1; Noël de la Morinière, S. 1795.1; Pearcey, F. G. 1884.1; Schneider, J. G. 1788.2; Sim, G. 1883.2; Watt, W. 1883.3; Ziegler, A. 1857.1; Anon. 366; Rappolt, C. H. Pre-Linn. 1739.1.

Various other Clupeidæ. — *Alewives.* Bean, T. H. 1881.4. — *Pilchard.* Bolitho, T. S. 1851.2; Cornish, T. 1883.3; Couch, R. Q. 1851.4. — *Anchovy.* Cunningham, J. T. 1893.7. — *Sprat.* Eichelbaum, E. 1911.1. — *Menhaden.* Grant, I. H. 1883.1. — *Clupeidæ (herring excepted).* Hoek, P. P. 1912.1. — *Shad.* Smith, C. J. 1880.2.

Migrations — Cont'd.

Migrations of the mackerel. ★Allen, E. J. 1897.3, 1909.1; B., G. A. 1878.1; Badenoch, L. N. 1903.1; Cligny, A. 1905.2; Collins, J. W. 1883.5, 1884.2; Dunn, M. 1893.1; ★Garstang, W. 1897.3, 1898.1; Martin, S. J. 1883.2, 3, 4; Morrison, W. D. 1829.1; Tanner, Z. L. 1883.1.

Migrations of the tunny (Thynnus). Bounhiol, J. P. 1911.1, 2, 3; Niewenglowski, G. H. 1913.1; ★Pavesi, P. 1887.1; Roule, L. 1913.6; Strabo, — Pre-Linn. 1472.1.

Migrations of other Teleostean fishes. — *Bluefish (Pomatomus).* Baird, S. F. 1871.39. — *Cottus.* Forsberg, A. 1898.1. — *Crappie (Pomoxys).* C., S. W. 1878.1. — *Galaxias, migration from sea to fresh water.* McCulloch, A. R. 1915.1. — *Mugil.* Gummerus, A. 1898.1; Roule, L. 1915.1, 3. — *Trigla.* Fulton, T. W. 1899.1; Meek, A. 1915.4. — *Whitefish.* C. 1878.1; Tomlin, W. D. 1888.1.

Marking experiments

For the determination of the rate of growth, the rate of travel during migrations, and other facts concerning their life histories, various experiments or attempts in marking fishes have been made, chiefly by the use of metal disks, by the removal of parts of fins, or by other recognizable mutilations. Some references to these attempts will be found under *Anguilla*, *Pleuronectidæ*, and *Salmonidæ*.

Other papers relating to the marking of North Sea fishes are Fulton, T. W. 1904.2; Garstang, W. 1905.5, 1912.1; Herdman, W. A., Scott, A. & Johnstone, J. 1905.1–1909.1.

Marking experiments on the cod (Gadus) in — the North Sea. Borley, J. O. 1909.1. — *in Icelandic waters.* Sæmundsson, B. 1913.1; Schmidt, E. J. 1907.1. — *Tagging adult cod at Woods Hole, Mass.* Smith, H. M. 1902.10. — *German experiments.* Redeke, H. C. 1909.1; Weigold, H. 1913.1.

Miscellaneous papers on migrations

Text in English. Aflalo, F. G. 1902.5; Agassiz, J. L. 1858.2; Anderson, J. 1800.1; Epton, J. 1883.1; Gould, N. E. 1885.1; Klippart, J. H. 1876.1; Lyman, T. 1868.2; Lyman, T. & Field, A. R. 1867.1; McDonald, M. 1885.2; Milner, J. W. 1880.1, 2; Norris, T. 1873.1; Thomson, J. H. 1878.2; Kirby, W. Add. 1835.1.

Text in French. Baude, J. J. 1861.1; Belloc, E. 1903.1; Duméril, A. H. 1866.3; Nillson, S. 1860.2; Rafinesque-Schmaltz, C. 1814.3; Watterbled, — Add. 1882.1.

Text in German. Buxbaum, L. 1892.1; Ehrenbaum, E. 1911.7; Franz, V. 1910.7, 10, 1911.2; Heincke, F. 1880.2; Jaeger, — 1911.1; La Valette St. George, A. 1901.1; Leonhardt, E. E. 1903.6; Mühlenhoff, K. 1885.1; Römer, F. 1909.1; Schiemenz, P. 1904.2.

Text in Norwegian. Huitsfeldt-Kaas, H. 1909.1.

Text in Russian. Gracianov, V. I. 1908.1.

MORTALITY

For diseases causing epidemics, see under Pathology.

For destruction through "Pollution" by industrial wastes, see Depletion under Fisheries.

Miscellaneous papers. Carbonnier, P. 1866.1; Hofmann, E. 1903.1; Pelletan, J. 1867.1; Petersen, C. G. 1886.1; Schmidt, F. 1874.2; Ysabeau, A. 1867.1; Anon. 640.

Winter killing in lakes; causes, etc., considered chiefly due to lack of oxygen. Kochs, W. 1891.1; Lühder, W. 1871.1; Nordqvist, O. F. 1897.7; Sandman, J. A. 1892.5.

PHYSICAL CAUSES OF MORTALITY

For instances of death caused by excessive cold and heat, see under Temperature, effects.

Earthquakes destroying fishes. — *At Catania, Sicily, in 1908.* Condorelli-Fr., M. 1909.1. — *Deep-sea fishes killed in the western Riviera, Italy.* Giglioli, E. H. 1887.1; Bellotti, C. Add. 1887.1. — *Fishes destroyed by eruption of Mt. Vesuvius.* Lo Bianco, S. 1907.1.

Hurricanes and monsoons, causing destruction. — *Monsoon off coast of India.* Denison, W. 1862.1. — *Destruction through hurricane of Jan., 1839, in Ireland.* Thompson, W. 1838.2. — *Hurricane at Scilly Is.* Anon. 236.

Lightning and thunder. *Thunder storms causing mortality.* Knauth, K. 1901.1, 2; Nicklès, F. J. 1868.1; Sandler, A. 1902.1. — *Fishes killed by lightning in Brenet See, Switzerland.* Zur Mühlen, M. 1911.3. — *Disappearance of fishes during electrical storms.* Coles, R. J. Add. 1914.1.

MORTALITY IN VARIOUS LOCALITIES

Records of occurrence of extensive mortality at — Manila, 1767. Gentil, W. 1781.1. — *South Africa.* Gilchrist, J. D. 1905.1. — *Malabar coast.* Jouan, H. 1875.1. — *On coast of Sumatra.* Marsden, W. Add. 1781.1. — *National Park Dam, New South Wales, 1888.* Ogilby, J. D. Add. 1888.5.

America. *Canada.* — *Bay of Fundy.* Adams, A. L. 1868.1. — *Near Cape Hatteras (codfish).* Leslie, C. C. 1883.1.

South America. — *Callao, Peru. Alleged cause; Hydrogen-sulphide.* Burt, J. L. 1852.1; Hutchinson, T. J. Add. 1873.1. — *In Rio de la Plata.* Lahille, F. Add. 1912.1.

United States. — *Blue gills (Lepomis pallidus) in Indiana.* Large, T. 1897.1. — *Salmon in McCloud R., Cal., 1881.* Stone, L. 1882.1. — *Minnesota.* Washburn, F. L. 1886.1. — *Rhode Island.* Knowles, H. M. 1887.1. — *Wisconsin, Racine R.* Hoy, P. R. 1872.1. — *Epidemic in Lake Mendota, Wis., 1884.* Dunning, P. 1884.1; Forbes, S. A. 1890.1.

Europe. *British Isles.* — *Haddock on coasts of Northumberland, Durham and Yorkshire.* Abbs, C. 1792.1. — *Between*

New Brunswick and England. Symonds, W. S. 1855.1. — *Mass mortality in Colne R. at Watford.* Brett, A. T. Add. 1890.1.

France. — *Marseilles: due to Hydrogen-sulphide.* Blanchet, R. 1844.1, 1845.1. — *In French rivers.* Charvet, P. A. 1869.1. — *Salmo salar in Loire R.* Rollinat, R. 1913.1. — *Pond fishes, 1788.* Varenne de Fenille, — 1789.1.

Germany. Schoenichen, W. 1904.1. — *Wrangelsburg (Prussia), 1863.* Clunie, J. & Boll, E. 1863.1. — *In Spree R.* Potters, K. 1896.1. — *In Neckar and Rhine rivers.* Zimmermann, E. R. 1907.1.

Italy. *Lake Comacchio: for epidemic destructive to eel (Pestis rubra anguillarum), see Diseases caused by Bacteria under Pathology.*

Russia. — *Goktscha lake.* Lebedintsev, A. A. 1905.4. — *Reval.* Murzajev, B. B. 1909.1. — *Malmby creek, Finland.* Nordqvist, O. F. 1902.2.

Switzerland. — *Esox in Lake Geneva, 1887.* Blanc, H. 1888.1; Fatio, V. 1887.1, Add. 1887.1. — *Alosa finta (Agoni) in Lake Lugano.* Heuscher, J. 1905.1; Mazzarelli, G. F. 1904.2, 1905.3, 1909.1; Studer, T. 1902.1.

Mortality in Gulf of Mexico and along Florida coast, and theories concerning causes, probably seismological or volcanic — so-called "poisoned water." Glennan, A. H. 1887.1; Moore, M. A. 1881.1; Nuñez Ortega, A. 1877.1, 2, 1879.1; Pierce, H. D. 1883.1, 1884.1; Stearns, S. 1878.2; Walker, S. T. 1883.1; Webb, J. G. 1886.1.

See also *Proc. U. S. Nat. Mus.*, vol. 1, 1878, pp. 244–246, 363–364; vol. 4, 1881, pp. 74–80, 121–127, 205; vol. 6, 1883, pp. 105–106.

For a recent review, see ★Taylor, H. F. in *Rept. U. S. Bureau Fisheries*, 1917, Append.

MUSEUMS OF THE WORLD

No attempt has been made here to notice the literature relating to researches on material in the various museums. The publications of the museums concerned ordinarily comprise the bulk of such contributions.

The following list includes guide-books, and lists or catalogues of particular or special collections.

For plans for exhibition of fishes, methods of installation, taxidermy, etc., see under *Collection, preservation and exhibition.*

ASIATIC MUSEUMS

Indian Museum at Calcutta: guide. Alcock, A. W. 1899.2.

Museum Bombay Nat. Hist. Soc.; catalogue. Bassett-Smith, P. W. 1897.1.

Government Central Museum, Madras; cat. Bidie, W. 1874.1.

Colombo Museum, Ceylon; notes. Haly, A. 1886.1. — *Guide.* Willey, A. 1906.1.

Japan: Imperial Museum, Tokyo; catalogue. Ishikawa, C. & Matsuura, K. 1897.1.

Siberia: Government Museum at Tobolsk. Pignatti, V. 1910.1.

Singapore: Raffles Museum; report, 1903. Hanitsch, R. 1904.1.

See also "Notes on Asiatic Museums" by B. Dean in *Pop. Sci. Monthly*, 1906, pp. 481–497.

AUSTRALIAN MUSEUMS

Queensland Museum; exhibit. Ogilby, J. D. 1907.1.

EUROPEAN MUSEUMS

Austria-Hungary: *Zagreb Zool. Museum; Cat.* Langhoffer, A. 1904.1.

University of Vienna; Zool.-Comp. Anat. Coll. Werner, Franz. 1904.1.

Salzburg Municipal Museum, notice of. Zetter, J. T. 1859.1.

Belgium and Luxembourg: *Luxembourg Nat. Hist. Museum; cat. Congo fishes.* Boulenger, G. A. 1909.1.

Brussels, Royal Museum; exhibit, fossil fishes. Dupont, E. F. 1887.1.

British Isles: *Bibliography, Museums of United Kingdom.* 3 vols. Murray, D. Add. 1904.1.

Bath Museum; list, fossil types. Wilson, E. 1892.1. — *Moore fossil coll., list.* Winwood, H. H. 1905.1.

Brighton Museum; cat., Cretaceous fossils. Willett, H. 1871.1.

Bristol Museum, List, fossil types. Wilson E. 1890.1.

Cambridge; Geol. Museum Cambridge Univ.; vertebrate fossils. M'Coy, F. 1854.1.

— *Woodwardian Museum; cat., type fossils.* Woods, H. 1891.1, 1893.1; Woodward, J. Pre-Linn. 1728.2.

Gosport; Haslar Hospital Museum. Baikie, W. B. Add. 1852.2.

Liverpool Univ. College; cat., fisheries coll. Herdman, W. A. 1897.1; Herdman & Scott, A. 1897.1.

London; British Museum; catalogue. Boulenger, G. A. 1895.2. — *Guides.* Günther, A. C. 1859.1, 1887.2; Ridewood, W. G. 1908.1. — *List.* Gray, J. E. 1851.1.

— *Catalogues of fossil coll.* Davies, W. 1871.1; Woodward, A. S. 1885.1, 1889.2, 1904.2, 1905.1. — *Fossil collections of Lord Cole and Sir Philip Grey-Egerton.*

Egerton, P. G. 1836.1, 1841.1, 1869.1. — *Linnæan Coll.* Goode, G. B. & Bean, T. H. 1885.4; Günther, A. C. 1899.2.

— *L. T. Gronow coll., cat.* See also under *Denmark, below.* Gray, J. E. 1854.1.

— *Types American fishes.* Jordan, D. S. 1880.4, 1884.4. — *Museum Petiveriani; description.* Petiver, J. Pre-Linn. 1695.1.

— *Catalogue, J. Banks' coll.* Dryander, J. Add. 1796.1.

London; Royal College of Surgeons. — Teratological series, cat. Lowne, B. T. 1893.1. — *Fossils; cat.* Owen, R. 1854.1.

— *Physiol. series comp. anat., cat.* Owen, R. Add. 1833.1; Stewart, C. Add. 1900.1.

London; Collection of fossils of J. Tennant; catalogue. Woodward, S. P. 1858.1.

Museum of Field Naturalists & Scientific Soc., Malton, Yorkshire; fossil coll. Woodward, A. S. 1889.12.

Manchester; Owens College; catalogue of types and figured specimens in geol. dept. Bolton, H. 1893.1, 1894.1.

Museums — Cont'd.

Musæum Tradescantianum. Now in Ashmolean coll., Oxford. First cabinet of natural curiosities in England. Tradescant, J. Pre-Linn. 1656.1.

Norwich Castle Museum, Norfolk; list of fossils. Leney, F. 1902.1.

Dublin Science and Arts Museum. — Cat., fossils. Lydekker, R. 1887.1; Davis, J. W. Add. 1888.1. — Catalogue, local fishes. Scharff, R. F. 1889.1.

Lord Cole's collection of fossils, at Florence Court, Enniskillen, Co., Fermanagh, Ireland. Cole, W. W. 1869.1; Egerton, P. M. 1836.1; 1841.1.

Edinburgh Museum of Science and Art. — "Powrie coll." of fossils. Traquair, R. H. 1892.2. — Fossil Fishes. Woodward, A. S. 1898.4, 5, 1899.1.

Denmark: *Museum Gronovii*, now in Brit. Museum. See also Gray, J. above, under London. Gronovius, L. T. Pre-Linn. 1754.1.

Museum regium (Copenhagen Museum); cat. Jacobæus, O. Pre-Linn. 1710.1.

Finland, see below under Russia.

France: *Musée d'Hist. Nat. d'Elbeuf*; fossil fishes. Coulon, L. 1903.1.

Paris; *Muséum National d'Histoire Naturelle*. Bernard, P. & others, 1842.1. — *Exhibits of Osteology*. Brühl, C. B. 1856.1, 1887.1. — *Catalogues*. Duméril, A. H. 1858.2; Guichenot, A. 1865.1, 1866.1, 2, 1868.1; Pellegrin, J. 1905.1, 1906.1. — *Guide*. Lacépède, B. 1795.1. — *Accounts*. Marcou, J. 1869.1; Sauvage, H. E. 1880.1–1916.1; Vaillant, L. L. 1890.1. — *Types of Monte Bolca fishes*. Eastman, C. R. 1905.7. — *Types of American fishes*. Jordan, D. S. 1880.4, 1884.4. — *Types of Cuvier*. Jordan, D. S. 1887.7.

Germany: Berlin; *Zoological Museum*; types, American fishes. Jordan, D. S. 1884.4.

Berlin; *Märkisches Provinzial Museum*; — fisheries exhibit. Friedel, E. 1880.1.

Breslau; *Mineralogisches Museum*; collection Devonian fishes. Gürich, G. 1891.1.

Gottorp Castle Museum, Oldenburg. (Partly removed to St. Petersburg.) Olearius, A. Pre-Linn. 1666.1.

Cat. *Repositorium Valentinianum*, Giesen. Valentini, M. B. Pre-Linn. 1704.1.

Halle Univ.; history of zoological collections. Taschenberg, E. O. 1894.1.

Munich; *Palæontological Museum*. Riess, J. A. 1887.1.

Nuremberg; *Museum Besleriani*; account. Besler, B. Pre-Linn. 1716.1.

Senckenberg; *Museum naturforschenden Gesellschaft*; collection of fish skeletons. Rüppell, W. P. 1852.1.

Italy: Collection of Aldrovandi, Bologna. (Still in existence.) Aldrovandi, U. Pre-Linn. 1648.1.

Ancona; *R. Istituto Tecnico*; cat. Pao-lucci, L. 1867.1, 1880.1.

Cremona; *Royal Palace*; fossil coll. Stefano, G. 1906.1.

Florence; *Museo Imperiale di Fisicae Storia Naturale*. Martelli, U. 1903.1. — Collection, G. E. Rumpf. Targioni-Tozzetti, G. 1903.1.

Genoa; *Municipal Museum* (*Museo Civico di Storia Naturale*). Vinciguerra, D. 1879.1.

— Univ. of Genoa; coll. Pollini, C. 1889.1.

Milano; *Museo civico*. Bellotti, C. 1878.1, 1890.1.

Naples; *Museum of Ferrante Imperato*. Imperato, F. Pre-Linn. 1593.1.

Parma; Univ. of; fossil coll. Stefano, G. 1912.1.

Ravenna; *Museum Ginanni*. Zampieri, C. Add. 1762.1.

Rome; *University of Rome*. Carruccio, A. 1899.1, 1903.1, 1906.1, 1908.1, 1912.1.

Rome; Kircher's collection, still in Jesuit College. Buonanni, F. Pre-Linn. 1709.1; Kircher, A. Pre-Linn. 1678.2.

Venice; *Istituto Veneto di Scienze, Lettere ed Arti*. Trois, E. F. 1875.1, 1876.2, 5, 1880.3.

Verona; *Museum Fr. Calceolarii*; later added to Moscardo's coll. Chiocco, A. Pre-Linn. 1622.1.

Verona; *Museum of Conte Lodovico Moscardo*. Monte Bolca fishes. Moscardo, L. Pre-Linn. 1656.1.

Verona; Monte Bolca fishes in Museo Bozziano. Volta, G. S. 1787.1–1796.1; Gazola, G. Add. 1796.1.

Madeira Is.: *Ponta Delgada Museum*. Collett, R. 1897.2.

Monaco: *Musée Océanographique*; collection of Selachii. Roule, L. 1912.2.

Netherlands: Amsterdam; *Museum Sebæ*. First Seba museum removed to St. Petersburg by Peter the Great, 1716; descr. of second (now dispersed). Seba, A. Pre-Linn. 1734.1.

Amsterdam; Swammerdam's coll., cat. Swammerdam, J. Pre-Linn. 1679.1.

Haarlem; *Musée Teyler*; palæontological coll. Winkler, T. C. 1863.1, 1878.1.

Leyden; *Muséum d'Histoire Naturelle des Pays-Bas*, cat. ostéologique. Lidth de Jeude, T. W. 1898.1.

Portugal: *University of Coimbra*. Vieira, L. 1894.2, 1897.1, 1898.1, 1900.1, 1901.1.

Lisbon; *Museu Nacional*. — *Catalogues*. Capello, F. de B. 1868.1, 1870.1, 2, 1871.1, 1873.1, 1876.2; Guimaraes, A. R. 1884.2, 1885.2. — *Types of albinism*. Seabra, A. F. 1909.1.

Russia: Finland. — *Gifts to Finnish Zool. Museum*. Levander, K. M. 1893.1. — *Annual reports*. Mela, A. J. 1886.1–1888.2.

Kazan Univ.; cat. Meissner, V. I. 1907.3.

Moscow; *Imperial Univ.*; list. Kavraiskii, T. T. 1893.1; Zograf, N. Y. & Kavraiskii, T. T. 1889.1.

St. Petersburg; *Museum Imperial Academy of Science*. Berg, L. S. 1912.2; Jasch-schenko, A. P. 1896.1; Koelreuter, J. G. 1761.1. — *For collections brought from other countries by Peter the Great*, see Olea-

rius, under Germany (Gottorp), and Seba, under Netherlands (Amsterdam).

Tiflis; Caucasian Museum; account. Radde, G. F. 1899.1.

Spain: Madrid; Real gabinete de historia natural. Bru de Ramon, J. B. 1786.1.

Instituto de Jovellanos. Jiménez de Cisneros, D. 1904.1.

Sevilla; University Museum. Calderon y Arana, L. Add. 1889.1.

Sweden: Stockholm; Museum Adolpho-Friderici, Palace of Ulricsdahl; descriptions. Balk, L. Pre-Linn. 1749.1; Linnæus, C. Pre-Linn. 1754.1.

Upsala; Univ. Thunberg, C. P. 1787.1. — Linnæan type-specimens. Lönnberg, A. J. 1896.3. — List of Japanese fishes. Nyström, E. 1887.1.

Switzerland: Geneva; Nat. Hist. Museum; fossil fishes. Woodward, A. S. 1898.5.

NORTH AMERICAN MUSEUMS

Canada: Fisheries Museum; reports. Halkett, A. 1905.3, 1907.1, 1910.2.

Mexico: Museo Nacional; cat. Herrera, A. L. 1896.1.

United States

Connecticut: Yale Univ.; Triassic coll. Eaton, G. F. 1903.1. — Wesleyan Univ. Goode, G. B. 1877.1, 1878.12, 1879.4.

District of Columbia: Washington; U. S. National Museum. — Reports. Bean, T. H. 1884.9, 1889.18, 1890.25, Add. 1885.1–1893.1. — Collection of European fishes. Bean, T. H. 1879.7. — Selachians. Garman, S. 1885.4. — List of publications. Geare, R. I. 1906.1. — Fossil coll. List of type specimens. Merrill, G. P. 1907.1. Collection of Prof. O. C. Marsh. Walcott, C. D. 1900.1. — Fossil fishes. Eastman, C. R. Add. 1917.3. — Mounted collection. Shufeldt, R. W. 1894.2, 3.

Washington: Smithsonian Institution. — List of publications, 1846–1903. Rhees, W. J. 1882.1, 1903.1. — History. Gill, T. N. Add. 1897.2.

Massachusetts: Boston; Boston Soc. Nat. Hist. — reports. Putnam, F. W. 1861.1, 1863.1, 1866.8, 1869.2, Add. 1868.1. — Additions to collections, 1842. Storer, D. H. 1844.13, 14, 16.

Mass.: Cambridge; Museum Comp. Zool. Garman, S. 1879.1, 1881.1, 1890.5. — Calionymidæ and Gobiidæ. Eigenmann, C. H. & Eigenmann, R. S. 1882.2, 1888.2.

New York: Albany; State Museum. Anon. 341, 342. — Type specimens Paleozoic fossils; cat. Clarke, J. M. 1903.1. — Accessions, 1849–1850. Gebhard, J. 1850.1.

New York: American Museum of Natural History. — Exhibit of fishes. Nichols, J. T. 1910.1. — Palæontological coll.; general account. Dean, B. 1904.3; additions to Devonian coll. 1899.1, Jay Terrell coll. 1900.3, restorations. 1911.2, 1912.3, 4, 1914.1; catalogue. Hussakof, L. 1908.1; progress of palæontology. Hay, O. P. 1905.1; history of fossil collection. Hovey, E. O. 1900.1. cat., fossil types. Whitfield, R. P. & Hovey, E. O. 1900.1.

Ohio: Cincinnati Soc. Nat. Hist. cat. James, J. F. 1887.1.

Pennsylvania: Philadelphia; Acad. Nat. Sci. — Types of fishes. Fowler, H. W. 1902.5. — Index to scientific contents of the Journal and Proceedings. 1812–1912. Nolan, E. J. 1913.1.

Pennsylvania: Pittsburgh; Carnegie Mus.; cat., fossil fishes. Eastman, C. R. 1911.1.

Texas: University of Texas; list of fossil types. Montgomery, T. H. 1904.1.

SOUTH AMERICAN MUSEUMS

Brazil: — Rio de Janeiro; Museu Nacional. Ribeiro, A. 1903.1, 1904.1. —

Para; Museu Goeldi. Snethlage, E. 1909.1.

Chile: Santiago; Museo Nacional; cat. Quijada, B. 1912.1, 1913.1.

MYOLOGY (OF FISHES)

Comprising the structure and development of the muscular system.

For the eye muscles, see Oculo-motor apparatus under Eye.

The heart muscles are included with and treated under Heart.

For the electrical organs, which are derivatives of, or which are transformed muscles, see under Electrical Fishes.

For the general function of the muscles, see under Locomotion.

For technique in the study of muscular contraction in respiration, see under Technique and Methods.

For the chemical composition of the muscles, see Analysis of flesh under Chemistry.

For an excellent treatise in English on the musculature of the salmon which may be used as a manual for the dissection of the muscles of a typical bony fish or teleost, see ★Greene, C. W. & Greene, C. H. Add. 1914.1.

Another valuable paper, on the myology of *Amiurus*, is ★McMurrich, J. P. 1884.1.

Development of muscles

For an excellent general account, in German, of the development of the muscular system, with a full bibliography, see ★Maurer, F. 1906.1.

Miscellaneous and general. Balfour, F. M. 1877.1; ★Braus, H. 1898.1, 1899.1; Gad, — 1877.1; Lebert, H. 1849.1; ★Maurer, F. 1894.1–1912.1; Schmalhausen, J. J. 1912.1 (i). — Early stages in differentiation of myotome and sclerotome. ★Sunier, A. L. J. 1911.1.

Development of the muscles in various fishes. — Elasmobranchii. Kastschenko, N. 1890.2; Schneider, A. F. 1890.2; ★Kaestner, S. Add. 1892.1. — Petromyzon ★Schiefferdecker, P. 1911.1. — Teleostei. Vialleton, L. 1902.3.

Histology of striated muscle

Miscellaneous and general. Baumhauer, E. H. 1848.2; Bornaud, E. 1887.2; Emery, C. 1881.1; ★Hirschler, J. 1910.1; ★Lämsimäki, T. A. 1910.1; Munk, H. 1858.1; Leeuwenhoek, A. Pre-Linn. 1723.1.

Myology — Cont'd.

Muscle fibers preserved in the Devonian fossil, Cladoselache. Dean, B. 1901.4, 1902.3.

Phylogenesis of striated muscle fibers. Maurer, F. 1900.1. — *Muscle fibers, regeneration.* Schmincke, A. 1907.1.

Continuity of muscle fiber and tendon. Schultze, O. 1911.1.

Degeneration of muscle fibers and their function as connective tissue in embryonic selachians. Thulin, I. 1914.1.

Structure of striated muscle in various fishes. — *Trout.* ★Heidenhain, M. 1913.1, .2. — *Petromyzon.* Keferstein, W. M. 1859.2. — *Rays.* Ranvier, L. A. 1873.1. — *Petromyzon.* Renaut, J. & Dubreuil, G. 1905.1.

For the occurrence of striated muscle fibers in the intestine of certain teleosts, see Tunica muscularis under Alimentary canal.

Innervation of striated muscle

Being chiefly the peripheral terminations of motor nerves in the voluntary or striated muscle fibers. Baglioni, S. 1909.1; Belousov, N. 1909.1; Bisselick, J. W. 1905.1; Boeke, J. 1902.2, 1908.2; Cavalié, M. 1902.1, 1904.3; Ciaccio, G. V. 1877.2, .3, 1882.1, 1883.1; Fusari, R. 1901.1, 1905.1; Giacomini, E. 1898.2, .3; ★Huber, G. C. & De Witt, L. 1898.1; Kallius, E. 1897.1; Razzauti, A. 1914.1; Retzius, M. G. 1892.7; Supino, F. 1898.1; Trinchese, S. 1892.1; Wikström, D. A. 1897.1, 1903.1.

Demonstration of continuity between nerve cell and muscle cell from the very first separation of the two sets of elements (Lepidosiren). Kerr, J. G. 1902.1, 1904.2.

Innervation of striated muscles by sensory nerves. Poloumordwinoff, D. 1899.1, 1902.2; Wunderer, H. 1908.1.

ANATOMY OF MUSCLES**Musculature in general**

The following references, in general, include the complete muscular system, i. e., both cranial and body musculature.

Miscellaneous and general. Baudelot, E. 1867.1; Carlisle, A. 1805.1; ★Jaquet, M. 1897.2; Kuhl, H. & Hasselt, J. K. 1820.1, 1824.1.

Muscular system of Amphioxus. Grenacher, H. 1867.1; Rhode, E. 1892.1.

Anatomy of muscles of Cyclostomata. — *Myxinidae.* Cole, F. J. 1905.1 (ii). — *Cyclostomata.* Grenacher, H. 1867.1. — *Petromyzon.* Stannius, F. H. 1851.1.

Structure of the muscles in Elasmobranchii. Chaine, J. 1902.1. — *Mustelus.* Humphry, G. M. 1872.3. — *Raja.* Ranvier, L. A. 1873.1.

Morphology of the muscles in Ganoidei and Dipnoi. — *Polyodon.* Danforth, C. H. 1913.1; Handyside, P. D. 1875.1 (ii). — *Neoceratodus and Protopterus.* Humphry, G. M. 1872.1, 2 & add. 1872.

Structure of the muscles in various Teleosts. — *Salmo.* Bruch, C. W. 1861.3. — *Malopterurus.* Cleland, J. 1858.1. —

Plectognaths. Rosén, N. 1912.1 (iv). — *Carassius.* Schiefferdecker, P. 1909.1. — *Luvarus.* Haller, B. Add. 1881.1.

MYOMERES OR MYOTOMES

The muscle-masses of Teleosts are composed on each side of a series of transverse segments (myomeres) which are separated from each other by bands or fasciæ of fibrous connective tissue (myosepta or myocommata).

Variation in form or shape and arrangement of myomeres. Anderson, R. J. 1889.1; Dietz, P. A. 1909.1, 1913.1; Houssay, F. 1909.2, 1912.2; Wikström, D. A. 1897.1, 1903.1.

Trunk-myotome form in Petromyzon and Acanthias. Langelaan, J. W. 1904.1. — *Trunk-myotome form as influenced by fins.* Tricht, B. 1907.1, .2.

Actual counts of the number of myomeres in numerous adult selachians and teleosts. Magnan, A. & La Riboisière, J. 1912.1.

Cranial and visceral muscles

Muscles with their insertions in the jaws and visceral arches and serving to move these structures. Inclusive of mandibular and pharyngeal muscles.

A noteworthy treatise on the cranial and visceral musculature of Amia, with magnificent illustrations, is that of ★Allis, E. P. 1895.1, 1898.2.

For a general treatise on the embryological development and homologies of the cranial muscles of vertebrates including fishes, see ★Edgeworth, F. H. 1911.1.

For an illuminative paper in English on the morphology of the visceral muscles of Selachii, see ★Marion, G. E. 1905.1.

A recent treatise summarizing the homologies of the several jaw muscles throughout the vertebrate series is ★"A memoir on the phylogeny of the jaw muscles in recent and fossil vertebrates" by L. A. Adams. Ann. N. Y. Acad. Sci., 1919, vol. 28, pp. 51-166, pls. i-xiii.

Muscles of the jaws, adductor and depressor mandibulæ, etc., respectively closing and opening the mouth. They include as parts, the M. constrictor I. dorsalis (M. levator maxillæ superioris), M. levator palatoquadrati, M. spiracularis, etc. These muscles are innervated by the trigeminal and facial nerves.

Structure in Elasmobranchii (sharks and rays). Edgeworth, T. H. 1902.1; Fürbringer, M. 1895.1; ★Luther, A. F. 1909.3, 1913.2; Marion, G. E. 1905.1; ★Tiesing, B. 1895.1.

Structure in Teleostei. Arcangeli, A. 1911.1; Ayres, W. O. 1848.5; Chaine, J. 1904.1, 1905.2; ★Vetter, B. 1878.1; ★Dietz, P. A. 1912.2, Add. 1914.1. — *Gadus.* ★Holmquist, O. 1911.1. — *Silurus glanis.* ★Juge, M. 1899.1.

Structure in Cyclostomata. Fürbringer, P. 1874.1, 1875.1. — *Dinichthys.* Gregory, W. K. 1915.2. — *Amia.* McMurrich, J. P. 1885.1. — *Hypoglossus musculature, development.* Neal, H. V.

1897.1. — *General*. Teutleben, E. Add. 1874.1.

Branchial or respiratory musculature, or the mechanism for opening and closing the gill clefts, including both internal and external interbranchials. The preceding references also include this subject. Albrecht, P. 1876.1; Bazin, A. 1839.2,3; Borc  a, J. 1907.1,4; Favaro, G. 1902.1; McWilliam, J. A. 1885.1; Remak, R. 1843.1.

Musculus protractor hyoidei (M. geniohyoideus, auct.), extending from ceratohyal to symphysis of dentary. ★Albrecht, P. 1876.1; Anderson, R. J. 1881.1; Cha  ne, J. 1900.2, 1901.1; ★Holmquist, O. 1910.1, 1911.1, 1913.1, Add. 1910.1; Rouvi  re, H. Add. 1906.1; Zavattari, E. Add. 1910.1.

Limb and trunk muscles

By morphologists (Gegenbaur, Kingsley et al.) the trunk musculature is regarded as divisible horizontally into dorsal (epaxial) and ventral (hypaxial) portions, the line of division being marked by a horizontal partition of connective tissue.

The following references, chiefly to teleosts, include in general the structure of the entire trunk musculature including the muscles of the fins. ★Chevrel, R. 1913.1; Greene, C. W. 1913.1; Hartmann, R. 1881.1; Hindersson, H. A. 1910.1; Knauer, F. K. 1910.1; ★Maurer, F. 1892.1–1912.1; Reichert, C. B. 1871.1; Schmalhausen, J. J. 1912.1 (ii).

Musculature of dorsal fin in — Motella. Bogoljubsky, S. 1908.1 — *Hippocampus*. Ranvier, L. A. 1874.1; Rollett, A. 1888.1; Schultze, O. 1911.1.

Supracarinales of Teleostei. Favaro, G. 1902.2. — "*Rectus abdominis*" of *Petromyzon*. Schneider, A. F. 1882.1.

Dorso-ventral division of lateral muscles considered empirical, and lateral muscle in teleosts regarded as composed of a single layer. Shann, E. W. 1914.1.

MYTHOLOGY AND SYMBOLISM

For the Christian fish symbol, see under Theology.

For a valuable recent work in English, treating extensively the mythology and symbolism of fishes among the Greeks and Romans, Egyptians, and Assyrians, see ★Wm. Radcliffe, "*Fishing from the earliest times*," London. 1921. 478 p.

General treatises. Folk-lore and legends; fictitious and mythical fishes, etc. ★Gubernatis, A. 1872.1; Hulme, F. E. 1895.1; ★Robinson, P. S. 1883.1; Vinycomb, J. 1906.1; Watkins, M. G. 1896.1; Sebillot, P. Add. 1901.1.

The great sea-serpent, its identification with fishes. Collett, R. 1884.1; Holder, C. F. 1903.3; Holder, C. F. & Jordan, D. S. 1913.1; ★Oudemans, A. C. 1893.1; Smith, H. M. 1904.1; Anon. 496.

Fishes as mystic symbols in China and Japan. Carus, P. 1911.1; Laufer, B. 1912.1. — *Fish symbol of Egyptian paintings.* Mahler, E. 1913.1. — *Fish and*

water symbols. Norwood, J. W. 1912.1. — *The fish as a sexual symbol.* Eisler, R. Add. 1914.1.

Ichthyophobia or taboo of fish. Matthews, W. 1898.1. — *Fish totems in Torres Straits and New Guinea.* Haddon, A. C. & Rivers, W. H. Add. 1904.1; Seligmann, C. G. Add. 1910.1. — *Fishing myths and ceremonies in the Malay Peninsula.* Skeat, W. W. Add. 1900.1.

Hieroglyphics or markings believed or alleged to have been found on fishes. Pre-Linn. refs. Bartholinus, T. 1654.1; D  bel, H. W. 1718.1; Francus, A. 1591.1; Jeraucurius, A. 1588.1; Simson, A. 1622.1.

Miscellaneous papers on mythology. Anon. 738; Eckstein, K. Add. 1911.1. — Pre-Linn. refs. Castrillo, H. 1692.1; Kornmann, H. 1666.1; Lemnius, L. 1559.1; Picinelli, D. F. 1670.1; ★Rondelet, G. 1558.1; Vogelhaupt, J. 1670.1. — "*Trees producing fish.*" Duret, C. 1605.1.

Fishes in heraldry. Use of fishes in armorial bearings, seals, etc. Robinson, P. S. 1883.1; ★Moule, T. Add. 1842.1; Schulenberg, W. Add. 1911.1; Peacham, H. Pre-Linn. 1627.1.

Myth of the shipholder. The "shipholder" (Remora or Echeneis) was believed by ancient mariners to be the cause of the retardation or the standing still of ships even when under full sail in a good breeze. This phenomenon is now known to be caused by "dead-water" which is due to a layer of fresh or brackish water resting upon the denser sea water. A vessel moving in such a place creates waves in the boundary between the two water-layers whose conflicting currents stay the ship.

For the first scientific explanation of this phenomenon, see Ekman, V. W. 1906.1.

For a full review of all the known literature on this myth, with reproductions of early figures, see E. W. Gudger, in *Ann. Mag. Nat. Hist.* 1918, ser. 9, vol. 2, pp. 271–305; 1919, ser. 9, vol. 4, pp. 17–21.

NERVOUS SYSTEM

Comprising the morphology, development and physiology of the nervous mechanism.

Many of the parts of the nervous system have been treated separately. See Auditory organs, Brain, Eye, Gustatory organs, Lateral line system, Olfactory organs, Spinal cord, etc.

Anatomy and morphology in general. Reference should also be made to the various subdivisions of the nervous system below for the literature relating specifically to these constituent parts.

General treatises. Baudelot, E. 1883.1; Girgensohn, O. G. 1846.1; ★Johnston, J. B. 1906.1, 1907.1, 1913.1; Key, A. & Retzius, G. 1875.1.

Miscellaneous and general. Ap  thy, S. 1895.1; Bailly, E. M. 1824.2; Bazin, A. 1839.4; Bellonci, G. 1880.1; Cortese, F. 1846.1; Desmoulins, L. A. 1822.1,2,3; Dubreuil, E. 1885.1; Ebel, J. G. 1788.1;

Nervous System — Cont'd.

Fenner, C. W. 1835.1; Le Boux, M. 1887.1; Le Roux, M. F. 1887.1, Add. 1889.1; Swan, J. 1835.1; Treviranus, G. R. 1820.1; Zaghorskiĭ, A. P. 1833.1; Wittzack, J. C. 1817.1.

Amphioxus. ★Heymanns, J. F. & Stricht, O. 1898.1; Quatrefages, J. L. 1845.1; Rhode, E. 1892.1; Schneider, A. F. 1880.2.

Cyclostomata. — *Petromyzontidae*. Ahlborn, C. G. 1882.1, 1883.1; Alton, E. & Schlemm, F. 1838.1; Desmoulins, L. A. 1824.1, 1825.2. — *Myxine*. Retzius, A. J. 1822.1–1828.1; Sanders, A. 1894.1.

Dipnoi and Ganoidei. — *Polyodon*. Handyside, P. D. 1875.1. — *Protopterus*. Wiedersheim, R. E. 1880.2.

Elasmobranchii. Onodi, A. D. 1886.1; ★Savi, P. 1844.1; Szczawinska, W. 1898.1.

Teleostei. Gehuchten, A. 1894.1; Le Roux, M. 1887.1. — *Cyprinus*. Büchner, G. 1835.1. — *Lepadogaster*. Guitel, F. 1887.3. — *Argyrolepecus*. Handrick, K. 1901.1. — *Amiurus*. Wright, R. R. 1885.3.

Development and embryology. — *Squalus*. Neal, H. V. 1915.2. — *Petromyzon*. Shipley, A. E. 1886.1. — *Transient nervous system*. — *Selachii*. ★Beard, J. 1892.2, 1896.1, 3, 4; Dohrn, A. 1882.2 (xvii). — *Trout*. Rohon, J. V. 1884.1.

Epibranchial placodes. Landacre, F. L. 1908.1, 1912.1.

For other transient nervous structures, see also Giant ganglion cells under Spinal cord.

Histology. General treatises. Hannover, A. 1844.1; Lenhossék, M. 1894.1, 1895.1; ★Ramon y Cajal, S. 1899.1.

In various fishes. — *Myxine*. Holm, J. F. 1901.1. — *Teleosts*. Le Roux, M. 1887.1. — *Branchiostoma*. Quatrefages, J. L. 1845.1.

Physiology of the nervous system. For effects of extirpation of cerebrum, medulla, etc., see Physiological researches under Physiology.

For a comprehensive review of the physiology of the nervous system in all vertebrates, see ★Baglioni, S. Add. 1910.1.

General treatises. Girgensohn, O. G. 1846.1; ★Polimanti, O. 1911.3, 1913.1; Vulpian, E. F. 1864.1.

Miscellaneous and general. Bailly, E. M. 1824.2; Desmoulins, L. A. 1822.1, 2, 3; Flourens, M. J. 1825.1; Treviranus, G. R. 1820.1. — *Oxygen metabolism*. Baglioni, S. 1905.2; Buijtendijk, F. J. 1910.1. — *Branchiostoma*. Polimanti, O. 1910.1.

COMPONENTS OF THE NERVOUS SYSTEM**GANGLIA AND GANGLION CELLS**

It has been found impossible to separate Cranial and Spinal ganglia and ganglion cells from those belonging to the peripheral nervous system.

For ganglia of particular nerves, see those nerves under Peripheral nervous system.

Development and histology. Beard, J. 1892.1; ★Dohrn, F. A. 1882.2 (xvii); Schaffer, J. 1896.3; Schenk, S. L. 1877.1; Schultze, H. 1878.1. — *Lophius*. Antoni, N. 1907.1. — *Amphioxus*. Boeke, J. 1907.3. — *Selachii*. ★Gast, R. 1909.1. — *Raja*. Robin, C. P. 1847.5.

Occurrence of canals and alveoli in ganglion cells. Studnička, F. K. 1903.1, Add. 1899.1.

Cranial ganglia. Anatomy. Beard, J. 1885.1, 1888.2. — *Salmon embryos*. Fürst, C. M. 1900.2, 1901.1. — *Amphioxus*. Johnston, J. B. 1905.1.

Development. — *Elasmobranchii*. Beard, J. 1888.2; Guthke, E. 1906.1 (*Torpedo*); Klinkhardt, W. 1905.1; ★Mitrofanov, P. I. 1892.1.

Development of cranial ganglia, Ameiurus. Landacre, F. L. 1910.1.

Cerebro-spinal ganglia. Histological structure. Levi, G. 1906.1; Retzius, M. G. 1880.2, (*Myxine*) 1890.2. — *Petromyzon*. Tomaselli, A. 1907.1. — *Selachii*. Cannieu, — Add. 1899.1.

Spinal ganglia and ganglion cells.

Structure and development. Gehuchten, A. & Nelis, C. 1898.1; Holmgren, A. E. 1899.1, 1900.1; Kolster, R. 1899.2; Levi, G. 1911.1; ★Neumayer, L. 1906.1; Rawitz, B. 1882.1. — *Petromyzon*. Freud, S. 1879.1. — *Amphioxus*. Johnston, J. B. 1905.1. — *Cyclostomes*. Mawas, J. 1910.2.

Elasmobranchii. — *Pristiurus*. Lenhossék, M. 1892.1. — *Raja*. Wahlgren, F. 1852.1.

Teleosts. Trinci, G. 1905.1. — *Salmon*. Fürst, C. M. 1900.2, 1901.1. — *Lophius*. ★Holmgren, A. E. 1899.2. — *Perca*. Kolster, R. 1898.2.

Development of neural crest, out of which are formed dorsal spinal ganglia. Coggi, A. 1895.1, 2; Dohrn, F. A. 1882.2 (xx), 1892.1.

Sympathetic ganglia. Anatomy and morphology. ★Huber, G. C. 1897.1, Add. 1899.1. — *Elasmobranchii*. Diamare, V. 1902.1; Pitzorno, M. 1910.1–1913.1. — *Of heart, Sharks and Teleosts*. Vignal, W. V. 1880.1, 1883.1.

Incertæ sedis. "Ganglienleiste," structure of. Boeke, J. 1903.1; Dohrn, F. A. 1882.2 (xxii); Froriep, A. 1901.1.

Miscellaneous. — *Ganglion isthmi*. Johnston, J. B. 1905.4. — *Froriep's ganglion*. Ostroumov, A. A. 1889.2. — *Subcutaneous ganglion cells, Myxine*. Retzius, M. G. 1890.2. — *Sensory ganglia, histology*. Chase, M. R. Add. 1909.1. — *Anterior ganglionic cord, Torpedo and Pristiurus*. Coggi, A. 1895.2.

NERVES

Morphology and development. Büchner, G. 1836.1, 2; Harrison, R. G. 1906.1. — *Petromyzon*. Dohrn, F. A. 1882.2 (xiii). — *Nerves without ends*. Hyrtl, C. J. 1863.1. — *Lophius*. Raffaele, F. 1900.1.

Nerves classified on a functional basis. Motor nerves. — *Viscero-motor*

roots, *Amphioxus*. Johnston, J. B. 1905.1.
— *Motor nuclei, arrangement in Chimæra*. Kappers, C. U. 1912.1. — *Development, Lepidosiren*. Kerr, J. G. 1902.1, 1904.2.
— *Structure and functions*. Moreau, F. A. 1859.1, 1860.3, 1861.1.

For motor nerve terminations, see Myology, Innervation of striated muscle.

Sensory nerves. — *Structure and functions*. Moreau, F. A. 1859.1, 1860.3, 1861.1.

For sensory nerve terminations in striated muscle, see such heading under Myology.

Electrical nerves, see under Electrical fishes.

Nerve plexuses. — *Relations of pectoral and dorsal fin plexuses*. Fürbringer, M. 1879.1. — *Nerve plexuses, Elasmobranchii*. Braus, H. 1910.2, 1911.1. — *Trigemino-facialis plexus in Lota*. Goronowitsch, N. 1897.2. — *Nervus collector in teleosts*. Hammarsten, O. D. 1909.1; Punnett, R. C. 1900.1, 1901.1.

For segmental structure of motor nerve plexus, see under Metamerism.

Nerve tissue. *Histology and development*. Beard, J. 1892.1; Bornaud, E. 1887.1. — *Ganoidei and Teleostei*. Nemiloff, A. 1908.1; Sterzi, G. 1911.1.

For a comprehensive treatise on the tissues of the nervous system, see Held, H. 1909.1.

Nerve cells. *Histological structure*. Flemming, W. 1896.1; Held, H. 1896.1; Jacobsohn, L. 1910.1; Paladino, G. 1898.1; Schultze, H. 1878.1; Retzius, M. G. 1911.3. — *Petromyzon*. Kolster, R. 1898.1 (ii), (*Cottus*) 1900.1; — *Ganoidei and Teleostei*. Nemiloff, A. 1908.1. — *Chondrostei*. Valenti, G. 1891.1.

Various researches. — *Vacuolisation of nerve cells*. Athias, — 1906.1. — *Intracortical fibers*. Bottazzi, F. 1893.1. — *"Myelocytes."* Chatin, J. 1889.2. — *Nature of pericellular network*. Hatai, S. 1903.1. — *Neurone, significance of size*. Johnston, J. B. 1908.3. — *Teleneurones in Leuciscus*. Hoffmann, C. K. 1897.1. — *Intracellular fibrils, Lophius*. Holmgren, A. E. 1903.1; Mencl, E. (*Scyllium*) 1903.3. — *Physiology of nerve cells*. Jacobsohn, L. 1910.1. — *Nomenclature of nerve cells*. Nissl, K. 1895.1. — *Development of nerve cells in Selachii*. Pighini, G. 1905.1. — *Sensory cells of Golgi*. Ramon y Cajal, P. 1897.1. — *Canals and alveoli in axis cylinder*. Studnička, F. K. Add. 1899.1.

Nerve fibers or neurofibrils. *Histological structure*. Auerbach, L. 1912.1; Babukhin, A. I. 1868.1; Nemiloff, A. 1910.1; Retzius, M. G. 1910.1; Schultze, H. 1878.1. — *Significance of size*. Herrick, C. J. 1902.2. — *Neurofibrillar continuity*. Held, H. 1905.1.

Nerve fibres in ganglion cells. Bethe, A. 1900.1. — *Amphioxus*. Boeke, J. 1902.2. — *In retinal ganglia, Selachii*. Schnaudigel, O. A. 1905.1.

Origin and development. Babukhin, A. I. 1868.1; Neal, H. V. 1915.2.

NEUROGLIA

(Connective tissue cells of a supporting character).

Histological structure. Bonome, A. 1907.1; Catois, E. H. 1898.1; Fano, C. 1906.1; Mawas, J. 1910.1; Müller, E. 1899.1; Retzius, M. G. 1893.3; Sala y Pons, C. 1894.1; Terry, R. J. 1907.1; Valenti, G. 1891.1. — *Neuroglia in retina*. Sacchi, J. 1884.1.

Ependyma, columnar epithelial neuroglia cells which line the cavity of the central nervous system. — *Structure*. Franz, V. 1912.1; Retzius, M. G. 1891.4, 1893.3; Stendell, W. 1914.5; ★Studnička, F. K. 1899.2, 1899.5.

Ependymal grooves, including subcommissural organ. Structure and development. Dendy, A. 1913.1, (*Function*) Add. 1909.1; Nicholls, G. E. 1912.2; Sargent, P. E. 1903.1.

CENTRAL NERVOUS SYSTEM

See also Brain, and Spinal cord, indexed separately because of the great number of citations under each.

System of nomenclature based on functional divisions. Johnston, J. B. 1902.1.

Blood vessels of the central nervous system. Sterzi, G. 1907.1.

Anatomy and morphology. *General treatise*. ★Johnston, J. B. 1909.1. — *Cyclostomata and Selachii*. ★Sterzi, G. 1907.1.

Miscellaneous papers. Arsaky, A. 1813.1, 1836.1; Meckel, J. F. 1836.1; Sanders, A. 1878.1; Treviranus, G. R. 1820.1.

Anatomy and morphology in various groups of fishes. — *Amphioxus*. Ovsyannikov, F. V. 1868.1; Retzius, M. G. 1891.2; Steiner, J. 1886.3.

Cyclostomata. — *Petromyzon*. Desmoulins, L. A. 1825.1; Mayer, F. 1897.1. — *Myxine*. Retzius, M. G. 1891.3.

Dipnoi and Ganoidei. — *Dipnoi (Protopterus and Ceratodus)*. Burckhardt, C. R. 1891.2, 1892.2, 1905.1; ★Bing, R. & Burckhardt, C. 1905.1; Sanders, A. 1889.1. — *Polypterus*. Waldschmidt, J. 1887.1.

Elasmobranchii. Rohon, J. V. 1877.1; Sanders, A. 1887.1; Steiner, J. 1886.2, 3. — *Torpedo*. Borchert, M. 1903.1, 1905.1, 1906.1. — *Scymnus*. ★Burckhardt, C. R. 1907.1, (*Palæo-selachii*). 1911.1. — *Chimæra*. Valentin, G. G. 1842.2.

Teleostei. Grette, A. 1879.1; Stieda, L. 1868.1, 1870.1. — *Orthogoriscus*. Haller, B. 1891.1; Tagliani, G. 1894.1, 1895.1.

Development and embryology. *General treatises*. ★Kupffer, C. W. 1906.1. — *Cyclostomata and Selachii*. Sterzi, G. 1907.1.

Special researches. Peter, K. 1901.1. — *Teleostei*. Goette, A. 1873.1 (iii), 1878.2; Goronowitsch, N. Add. 1884.1. — *Central canal*. Rudnev, V. G. 1894.1. — *Earliest differentiation*. Schaper, A. Add. 1897.1.

Nervous System — Cont'd.

For formation of Medullary tube, see that heading under Embryology.

Histology. For a general account of the histological structure of the central nervous system, see ★Nansen, H. 1887.2.

Histological structure of the central nervous system in — *Lophius*. Fritsch, G. T. 1886.4. — *Amphioxus*. Joseph, H. 1904.1. — *Myxine*. Nansen, F. 1885.1, 1886.1. — *Esox*. Neumayer, L. 1895.1.

Meninges, membranes covering the central nervous system. — Pigmentation of sheath. Borchert, M. 1904.1. — *Membrana limitans externa*. Retzius, M. G. 1904.2. — *Meninx primitiva*. Sagemehl, M. 1884.1 (ii). — *Ontogeny, phylogeny and anatomy*. ★Sterzi, G. 1899.1–1902.2.

Phylogeny of central nervous system. Burckhardt, C. R. 1907.1; Gaskell, W. H. 1889.1, 2; Herrick, C. J. 1910.1; Steiner, J. 1888.1.

Reissner's fiber, a cord of fibers arising in the tectum opticum of the mid-brain and extending backward throughout the central canal of the central nervous system.

For the most comprehensive study of the structure and development of Reissner's fiber, see ★Nicholls, G. E. 1912.2.

Anatomy, development, functions, etc. Ayers, H. (*Myxinoidei*) 1908.1; Dendy, A. 1913.1, Add. 1909.1; Studnička, F. K. 1899.1.

Experimental investigations indicating functions as an aid in the flexure of the body. Nicholls, G. E. 1912.1.

Considered an optic reflex apparatus for transmission of motor reflexes. ★Sargent, P. E. 1900.1, 1901.1, 1904.1, Add. 1901.1.

PERIPHERAL NERVOUS SYSTEM

For the innervation of particular organs, see under those organs, such as Electrical organs under Electrical fishes, Heart, Striated muscles under Myology, etc.

For peripheral terminations of nerves of special senses, see Auditory organs, Eye, Gustatory, Olfactory and Tactile organs.

For the "End organs," see under Senses and Sense organs, and Lateral line system.

For a general treatise on the anatomy and physiology of the peripheral nervous system, see Stannius, H. 1849.1.

Anatomy and morphology in various fishes. — *Amphioxus*. Dogiel, A. S. 1903.1; Fusari, R. 1889.1; Kutchin, H. L. 1913.1. — *Ammocetes*. Julin, C. 1888.1. — *Teleostei*. Herrick, C. J. 1899.3; Stannius, F. H. (*Gadus*) 1842.2; Panschin, B. A. 1910.2. — *Selachii*. Müller, E. 1913.1.

Development. Beard, J. 1888.3, 1890.2; His, W. 1879.1; Kerr, J. G. (*Lepidosiren*) 1910.5; ★Lenhossék, M. 1905.1; Müller, E. (*Selachii*) 1913.1.

Histogenesis. ★Harrison, R. G. 1901.1; Kolster, R. 1899.1; ★Neumayer, L. 1906.1.

Phylogenetic relations. Herrick, C. J. 1910.1.

CRANIAL NERVES

General treatises. Gaskell, W. H. 1889.2; ★Johnston, J. B. 1902.4.

Anatomy and morphology. Cole, F. J. 1898.1, 3, 1899.1; Gaskell, W. H. 1888.1. — *Entrance of cranial nerves into medulla oblongata.* Droogleever Fortuyn, A. B. 1913.1. — *Spinal homologues of cranial nerves.* McMurrich, J. P. 1902.1. *Cyclostomata.* Johnston, J. B. (*Petromyzon*) 1905.2, 1908.1; Worthington, Julia (*Bdellostoma*) 1905.2.

Dipnoi. Pinkus, F. 1905.1. — *Ceratodus.* Beauregard, H. 1883.1; Wijhe, J. W. 1882.1. — *Protopterus.* Humphry, G. M. 1872.2; ★Pinkus, F. 1894.1.

Elasmobranchii. Ewart, J. C. 1889.1; Ewart, J. C. & Cole, F. J. 1895.1; Marshall, A. M. 1881.1; Pinkus, F. 1905.1. — *Raja.* Bonsdorff, E. J. 1857.1. — *Chimaera.* Cole, F. J. 1896.1, 1897.1; Cole, F. J. & Dakin, W. J. 1906.1. — *Torpedo.* Ewart, J. C. 1890.1. — *Hexanchus.* Gegenbaur, C. 1871.1. — *Chlamydoselachus.* Hawkes, O. A. 1906.1. — *Echinorhinus.* Jackson, W. H. & Clarke, W. B. 1876.1. — *Scyllium.* Marshall, A. M. & Spencer, W. B. 1881.1. — *Acanthias.* Meek, A. 1909.1; Strong, O. S. 1903.1.

Ganoidei. ★Wijhe, J. W. 1880.1, 1882.1. — *Amia.* Allis, E. P. 1895.1, 1898.2. — *Acipenser.* Goronowitsch, N. 1888.1; ★Johnston, J. B. 1898.1, 2.

Teleostei. Herrick, C. J. 1897.1, 1898.1. — *Scomber.* ★Allis, E. P. 1903.4; Dewitz, J. 1904.1. — *Gadus.* Cole, F. J. 1898.1, 1900.1; Herrick, C. J. 1900.1. — *Cyclothone.* Gierse, A. 1904.1. — *Menidia.* ★Herrick, C. J. 1899.1. — *Siluridae.* 1901.1; ★Juge, M. 1899.1. — *Esox.* Panschin, B. A. 1910.1. — *Macruridae.* Pfüller, A. 1914.1.

For segmental arrangement and value of cranial nerves, see Metamerism.

Development. ★Goette, A. 1914.1; Kupffer, C. W. 1891.1; Strong, O. S. 1891.1. — *Phylogeny.* Gaskell, W. H. 1898.1 (x), 1899.1.

Elasmobranchii. — *Chlamydoselachus and Spinax.* Brohmer, P. 1909.1; Guthke, E. 1906.1 (*Torpedo*); Marshall, A. M. 1881.1; ★Mitrofanov, P. I. 1892.1; Wijhe, J. W. 1882.2.

Teleostei. ★Barbieri, C. 1907.2, 1908.4; Goronowitsch, N. 1897.1, 1898.1.

Origin in the cells of the brain. ★Ahlborn, C. G. 1884.1 (*Petromyzon*); Dumeril, A. M., Flourens, M. J. & Duvernoy, G. L. 1854.1; Duvernoy, G. L. 1854.1; Goette, A. 1913.1; Philipeaux, J. M. & Vulpian, E. F. 1853.1; ★Wallenberg, A. 1907.1, 2.

Peripheral distribution of cranial nerves. In various fishes. — *Ammocetes.* Alcock, R. 1898.1; Cole, F. J. 1898.2. — *Mustelus.* Allis, E. P. 1901.1. — *Unsymmetrical distribution of cranial nerves.* Collinge, W. E. 1895.3.

For the peripheral distribution of the nerves of special senses, see under organs of

special senses, as Auditory organs, Eye, Gustatory organs, Olfactory organs, Tactile organs.

See also Lateral line system, and Sensory organs.

Cranial nerves
by name and number

Abducens (VI). *Anatomy and morphology.* — *General treatise.* ★Neal, H. V. 1912.1, Add. 1914.1. — *Ganoidei.* Schneider, H. 1881.1. — *Ameiurus.* Workman, I. S. 1900.1.

Motor nuclei, Lophius. Droogleever Fortuyn, A. B. 1909.1; Kappers, C. U. & Fortuyn, A. B. Add. 1909.1.

Auditory (VIII). (*For peripheral terminations of auditory nerve in membranous labyrinth of ear, see under Auditory organ.*)

Anatomy and development. Camper, P. 1763.1, 1774.1; Holmes, G. M. 1903.1. — *Acustico-lateral system, Bdellostoma.* Ayers, H. & Worthington, J. 1908.1. — *Structure of ganglion cells of N. acustico-facialis, Ammocetes.* Herms, E. 1885.1. — *Development.* Cameron, J. & Milligan, W. 1910.1.

Origin of auditory nerve in cells of brain. — *Teleosts.* Mirto, D. 1895.1, 1896.1. — *Petromyzon.* Rohon, J. V. 1882.1.

Phylogeny. Gaskell, W. H. 1898.1 (x); Kappers, C. U. 1909.1.

Physiology. — *Of vestibular branch of eighth nerve.* Carazzi, D. 1898.1. — *Effect of sectioning auditory nerve, Trigla.* Polimanti, O. 1913.2.

Facialis (VII). *Anatomy and morphology.* Friant, A. Add. 1879.1. — *Motor nucleus of facialis, Lophius.* Droogleever Fortuyn, A. B. 1909.1; Fortuyn, A. B. 1909.1, 2; Kappers, C. U. & Fortuyn, A. B. Add. 1909.1. — *Spinal ganglion of facialis.* Haller, B. 1910.1. — *Peripheral termination.* ★Ruge, G. H. 1897.1.

Phylogeny of facialis nerve. Gaskell, W. H. 1898.1 (iv); Kappers, C. U. 1909.1; Sheldon, R. E. 1909.2.

Branches of Facialis or VII nerve. *Chorda tympani branch.* — *Chimæra.* Cole, F. J. 1896.1. — *Comparative anatomy.* Froriep, A. 1887.1. — *Homologies in Selachii.* Green, H. A. 1900.1. — *Phylogeny.* Sheldon, R. E. 1909.2.

Gustatory branch of communis system of facialis. — *Relation to nerves of touch.* Herrick, C. J. 1906.3. — *Origin, Cyprinus.* Weber, E. H. 1827.7.

Other branches. — *Mandibularis externus facialis, variations, Gadus.* Holmquist, O. 1913.2. — *Horizontal branch, phylogeny.* Kappers, C. U. 1908.3. — *Lateralis branch, Mormyridæ.* Stendell, W. 1914.4. — *Buccal nerve, variation in origin.* Turner, W. 1867.2.

Glossopharyngeal (X). *Presence or absence in myxinoids.* Johnston, J. B. 1908.2.

Hypoglossal (XII), so-called by authors cited; probably, however, in fishes morpho-

logically equivalent to first spinal nerve. — *Rate of impulse in Bdellostoma.* Carlson, A. J. 1904.2. — *Question of existence in fishes.* Duval, M. 1877.1. — *Relations among various vertebrates.* McMurrich, J. P. 1885.1.

Mesencephalicus nerve. *Found in larval form (Ammocetes), sparingly in adult Petromyzon. Possibly a member of the transient nervous system (q. v.).* Tretjakoff, D. 1909.1.

Oculomotor (III). *Anatomy and morphology.* Harman, N. B. 1899.1; ★Neal, H. V. 1912.1, Add. 1914.1. — *Ganoidei.* Schneider, H. 1881.1. — *Ameiurus.* Workman, I. S. 1900.1.

Histology, ganglia of oculomotor nerve. — *Ciliary ganglion.* Beard, J. 1888.1; Ewart, J. C. 1890.2; Onodi, A. D. 1901.1, Add. 1887.1; Schwalbe, G. A. 1879.1. — *Intracranial ganglion, Scyllium.* Nicholls, G. E. 1915.1.

Histology, motor nuclei. Huet, W. G. 1911.1; Kappers, C. U. 1913.1.

Origin and development. Beccari, N. 1909.2; Harman, N. B. 1899.1. — *Elastomobranchii.* ★Gast, R. 1909.1; Sedgwick, A. 1895.1.

Olfactory (I). (*For peripheral terminations of the first nerve in the organ of smell, see under Olfactory organs.*)

Anatomy. — *Amia.* Brookover, C. 1909.1, 1910.1. — *Ameiurus.* Brookover, C. & Jackson, T. S. 1911.1.

Development. ★Locy, W. A. 1899.1. — *Nerve and ganglion, Lepidosteus.* Brookover, C. Add. 1914.1.

Physiology. Garten, S. Add. 1903.1. — *Velocity of conduction of impulses, Esox.* Nicolai, G. F. 1901.1, 1905.1. — *Effects of electrical stimulus, Esox.* Sulze, W. 1909.1.

Optic nerve (II) and Chiasma. *For peripheral terminations of the optic nerve see Retina under Eye.*

Stages in degeneration of optic nerve after removal of eye. Krause, K. 1898.1.

Anatomy of optic nerve. ★Deyl, J. 1896.2; Studnička, F. K. 1897.1, 1898.3. — *Acanthopsidæ and Siluridæ.* Deyl, J. 1896.1. — *Teleosts.* Messing, S. V. 1907.1. — *In the blind cave fish, Amblyopsis.* Ramsey, E. E. 1901.1. — *Syngnathus.* Studnička, F. K. 1901.3. — *Xiphias.* Malpighi, M. Pre-Linn. 1686.1.

Place of origin in brain. Bellonci, G. 1880.2, 1888.1; Stein, S. A. Add. 1834.1. — *As part of central nervous system.* Monroe, T. K. 1896.1.

Phylogeny. Gaskell, W. H. 1898.1 (ix).

Optic chiasma, structure. Rudolphi, C. A. 1800.1; Soemerring & Noethig, Add. 1791.1.

Optic chiasma in Teleostei. Fusari, R. 1896.1; Parker, G. H. 1901.1, 1903.2. — *Gadus.* Hoeven, J. 1832.1; Mayer, A. F. 1829.1. — *Clupea.* Weber, E. H. 1827.1. — *Engraulis.* Solger, B. F. Add. 1877.1.

Nervous System — Cont'd.

Dorsal position of either right or left nerve in the crossing is a matter of chance and not a heritable character as shown in breeding experiments with brook-trout and cod. Larrabee, A. P. 1906.1.

For changes in the optic tract accompanying migration of the eye in flatfishes, see under *Pleuronectidæ*. See especially Mayhoff, H. 1912.1; Williams, S. R. 1902.1.

Terminalis (Pinkus's nerve). A sensory nerve arising from the anterior part of the fore-brain and innervating the epithelium of the nasal sac. Discovered by R. Pinkus in *Protopterus* in 1894.

Anatomy. — *Amia* and *Lepidosteus*. ★Brookover, C. 1908.1, 1909.1, 1910.1. — *Ameiurus*. Brookover, C. & Jackson, T. S. 1911.1. — *Heptanchus*. Burckhardt, C. R. 1906.3. — *Selachii*. ★Locy, W. A. 1899.1, 1904.1, 1905.2. — *Selachii* and *Dipnoi*. ★Pinkus, F. 1894.1, 2, 1905.1. — *Teleosts*. Sheldon, R. E. 1909.1; Sheldon, R. E. & Brookover, C. 1909.1; Giacomini, E. Add. 1914.1.

Various researches on *N. terminalis*. — *Development in Selachii*. Belogolowy, G. 1912.1. — *Physiology, Selachii*. Kschischkowsky, K. 1912.1. — *Ganglion cells, Mustelus*. McKibben, P. S. 1914.1.

Trigeminal or Trifacial (V). Anatomy. Friant, A. Add. 1879.1; Valkenberg, C. T. Add. 1911.1. — *Gadus*. Baudelot, E. 1868.9. — *Muraenidæ*. Calandruccio, S. 1896.1. — *Lota*. Goronowitsch, N. 1897.2; Toppelius, O. A. Add. 1846.1.

Various morphological papers. — *End-organs in skin, Bdellostoma*. Ayers, H. & Worthington, J. 1907.1. — *Plexus ophthalmicus in Amia and Lepidosteus*. Belogolowy, G. 1912.1. — *Phylogeny of trigeminal*. Gaskell, W. H. 1898.1 (v, vii). — *Spinal ganglia of trigeminal*. Haller, B. 1910.1. — *Trigemino-facialis complex, Gadus and Ameiurus*. Herrick, C. J. 1900.2. — *Mesencephalic root*. Johnston, J. B. 1905.4. — *Parts innervated, Selachii, Ganoidei and Dipnoi*. Luther, A. F. 1909.3, 1913.2. — *Origin, Teleosts*. Orrù, E. 1913.1.

Branches of trigeminal nerve. — *Ganglia of ophthalmicus profundus in Selachii*. Beard, J. 1888.1. — *Mandibularis trigemini, variations, Gadus*. Holmquist, O. 1913.2. — *Ophthalmic branch, Ameiurus*. Workman, I. S. 1900.1. — *Lateralis branch, Lota and Silurus*. Weber, E. H. 1827.9.

For the muscles innervated by the Trigeminal nerve, see Cranial and visceral muscles, under Myology.

Trochlearis or Patheticus (IV). Anatomy and morphology. Dohrn, F. A. 1882.2 (xxv); ★Fürbringer, M. 1902.1; Kappers, C. U. 1913.1; ★Neal, H. V. 1912.1, Add. 1914.1. — *Teleostei*. Becconi, N. 1909.2; Franz, V. 1911.3. — *Ganoidei*. Schneider, H. 1881.1. — *Ameiurus*. Workman, I. S. 1900.1.

Various researches on morphology and development. — *Gadus, dorsal ramus*.

Baudelot, E. 1873.2, (*Homologies*). 1868.6. — *Development, Torpedo*. Froriep, A. 1891.1. — *Nuclei of trochlear nerve*. Huet, W. G. 1911.1.

Vagus or Pneumogastric (X). Anatomy and morphology. Baudelot, E. 1868.3, 1869.1; Hoffmann, C. E. 1860.1; Moreau, F. A. 1859.1; Onodi, A. D. Add. 1887.1; Bruner, G. Add. 1893.1. — *Selachii*. ★Dohrn, F. A. 1882.2 (xix, xxi). — *Cyclostomata*. Ransom, W. B. & Thompson, D. W. 1886.1.

Teleostei. — *Gadus*. Baudelot, E. 1868.9. — *Orthogoriscus*. Sauvage, H. E. 1910.1. — *Anguilla*. Waga, T. 1896.1.

Researches on origin and histology of vagus. — *Teleostei*. ★Haller, B. 1895.1, 1896.1. — *Selachii*. Rohon, J. V. 1878.1; Shore, T. W. 1889.1.

Physiology. — *Influence of section of nerve on gases of air bladder*. Bohr, C. 1894.1. — *Influence of pneumogastric on heart, sharks*. Cadiat, L. O. 1879.1. — *Rate of impulse, Bdellostoma*. Carlson, A. J. 1904.2. — *General account of physiology of vagus*. Hoffmann, C. E. 1860.1.

Lateralis system of vagus nerve. ★Fée, F. 1866.1, Add. 1869.1. — *Selachian embryos*. Dohrn, F. A. 1882.2 (xix). — *Lota and Silurus*. Weber, E. H. 1827.9.

SPINAL NERVES

Anatomy and morphology. Baudelot, E. 1868.11; Gaskell, W. H. 1888.1; Trinci, G. 1905.1, 1906.1. — *Amphioxus*. Balfour, F. M. 1876.3. — *Elasmobranchii*. Ewart, J. C. & Cole, F. J. 1895.1. — *Chlamydoselachus*. Hawkes, O. A. 1906.1. — *Cyclostomata*. Ransom, W. B. & Thompson, D. W. 1886.1; Schneider, A. F. 1880.2.

Anatomy in *Teleostei*. — *Teleosts*. Allis, E. P. 1898.2. — *First spinal nerves, Amia and Scomber*. Allis, E. P. 1895.1, 1898.1, 2, 1903.4. — *Scomber*. Dewitz, J. 1904.1. — *Menidia*. ★Herrick, C. J. 1899.1.

Various anatomical items. — *Distribution, Elasmobranchii*. Bardeen, C. R. 1904.1. — *Ventral ramus, anterior spinal nerves, Selachians*. Braus, H. 1892.1. — *Conceived as a complex of two separate nerves*. Wijhe, J. W. 1897.1.

Development. — *Elasmobranchii*. Balfour, F. M. 1875.2. — *Motor nerves, Selachii*. Dohrn, F. A. 1882.2 (xiv). — *Ventral development*. Neal, H. V. 1900.1, 1903.1. — *General account of development*. Sagemehl, M. 1882.1.

SPINO-OCCIPITAL NERVES

Development, homologies, and morphology. — *Homologies, Amia and teleosts*. Allis, E. P. 1898.1. — *Development, Selachii*. Braus, H. 1899.1. — *Morphology in Holocephali*. ★Fürbringer, M. 1896.1. — *In Amia*. Ganfini, C. 1912.1. — *In Teleostei*. Supino, F. 1907.3. — *In Ammocætes*. Wiedersheim, R. E. 1869.1, 1879.1, 1880.1, 3.

SYMPATHETIC NERVOUS SYSTEM**(Nervus sympathicus)**

Anatomy and morphology. Froriep, A. 1908.1; ★Jaquet, M. 1900.1; Marcus, H. 1910.1; Toppelius, O. A. Add. 1846.1. — *Petromyzon*. Julin, C. 1886.1, 1887.7; Ovsyannikov, F. V. 1883.1.

Elasmobranchii. ★Bottazzi, F. 1902.2; ★Chevrel, R. 1890.1; Diamare, V. 1902.1; Remak, R. 1837.1.

Teleostomi. — *Teleosts.* ★Chevrel, R. 1888.1, 1890.1, (*Acipenser*). 1893.1. — *Gadus*. Hjelt, O. E. 1847.1. — *Orthogoriscus*. Sauvage, H. E. 1910.1; Vulpian, E. F. 1865.1.

Development. Froriep, A. 1908.1; ★Ganfini, C. 1912.2; Kuntz, A. 1911.1; ★Neumayer, L. 1906.1. — *Elasmobranchii*. Hoffmann, C. K. 1901.1 (*Acanthias*); Sedgwick, A. 1895.1.

Various researches. — *Preoptic sympathetic system in Amia*. Brookover, C. 1909.1, 1910.1. — *Influence on functions of air bladder*. Harting, P. 1865.1. — *Evolution of sympathetic system*. Kuntz, A. 1911.2. — *Histogenesis*. ★Neumayer, L. 1906.1. — *Lesion in Rhombus*. Pouchet, G. 1875.3.

For segmental structure of Sympathetic nervous system, see Metamerism.

OLFACTORY ORGANS

For the functions of the olfactory organs, see Smell.

Development. *For a comprehensive treatise on the development of the olfactory organs, see* ★Peter, K. 1906.1.

Development in — Cyclostomata (Amnocoetes). Gaskell, W. H. 1898.1; ★Lubosch, W. 1901.1, 1904.2, 1905.1; Pogojeff, L. 1881.1. — *Teleostei*. Gawrilenko, A. 1910.1; Holm, J. F. 1894.1.

Development of olfactory organs in Selachii. ★Berliner, K. 1902.1; Holm, J. F. 1894.2; Sund, O. 1904.1, 1905.1; Wijhe, J. W. 1886.2.

Morphology, including microscopical structure.

Miscellaneous and general. Duméril, A. H. 1860.1; Geoffroy-Saint-Hilaire, E. F. 1825.1; ★Marshall, A. M. 1879.2; Scarpa, A. 1789.1.

Anatomy in various fishes. — *Mustelus*. Asai, T. 1913.1. — *Cyclostomata*. Ballowitz, E. 1904.1; Burne, R. H. 1908.1; Foettinger, A. 1876.1. — *Teleosts*. Burne, R. H. 1909.1; Dogiel, A. S. 1886.1; Solger, B. F. (*Gasterosteus*) 1893.1. — *Ganoidi*. Dogiel, A. S. 1886.1; Grimm, O. (*Acipenser*). 1872.1; Waldschmidt, J. (*Polypterus*). 1887.1. — *Amphioxus*. Kölliker, R. A. 1843.1.

Histological structure, including nerve terminations in end organs, etc. Aichel, O. 1897.1; ★Blaue, J. 1882.1; Jagodowski, K. P. 1901.1; Kölliker, R. A. 1857.5; Kolmer, W. 1905.1, 1907.1; Madrid Moreno, J. 1887.1, Add. 1887.1, Add. 1888.1; Pereyaslavtzeva, S. 1876.1;

Retzius, M. G. 1879.1, 1880.1, 3, 1892.3, 8; Sheldon, R. E. 1908.2.

Olfactory fossæ or nasal pits, morphology, functions, etc.

For a general treatise on the morphology and development of the nasal fossæ, see ★Dieulafoy, L. 1904.1, Add. 1906.1.

Communications of nares with pharynx in — Astroscopus. Dahlgren, U. 1908.2. — *Cynoglossus*. Johnstone, J. 1904.3; ★Kyle, H. M. 1900.6.

Position of nares in — Lepidosiren (anterior opening). Huxley, T. 1876.3. — *Ophichthyidæ*. Lütken, C. F. 1851.1.

Nares rudimentary or degenerate in Tetraodon. Wiedersheim, R. E. 1887.1, 2, 4.

Change of water in olfactory pits, Teleostei. Vescovi, P. 1889.1.

"*Monorhinie*" and "*Amphirhinie*," hypothesis advocated by von Kupffer attempting derivation of bilateral nostrils of gnathostomes from the single median monorhinal condition of Cyclostomes. Kupffer, C. W. 1894.1; Peter, K. 1906.1; Sund, O. 1905.1.

OTOLITHS

Comprising the "ear stones" as isolated structures, i. e. not in association with other parts of the ear.

For the functions of the otoliths, see under Hearing and the static sense.

For the determination of the age of fishes through the study of their otoliths, see under Age determination.

General accounts, size, shape, structure, etc. Canestrini, R., & Parmigiani, I. 1883.1; Scott, T. 1906.1; ★Shepherd, C. E. 1910.1, 2, 1914.1.

Structure of otoliths in — Pleuronectes. Immermann, F. 1908.1. — *Gadus*. Redfern, P. 1859.1. — *Petromyzon*. Studnička, F. K. 1912.1.

Miscellaneous papers of little value. Buckland, F. T. 1878.2; Geoffroy-Saint-Hilaire, E. F. 1824.9, 10; Jackson, P. 1879.1; Anon. 436; Klein, J. T. Pre-Linn. 1740.1.

Otoliths of species of Gadus dredged from depths of polar seas. Jensen, A. S. 1900.2, 1905.2.

Comparative studies of the otoliths of recent fishes for the purpose of the identification of isolated or fossil otoliths. Costa, O. G. 1866.1; Higgins, E. T. 1867.1, 1868.1; Ihering, H. 1891.1, 2; Koken, E. 1891.1, Add. 1891.1.

Fossil otoliths. *Because of their density, these are often the only remains of fishes preserved in fossil-bearing formations.*

Tertiary otoliths of various formations throughout the world. Bassoli, G. G. 1906.1, 1909.1; ★Koken, E. 1884.1–1888.1, Add. 1891.2; Meyer, O. 1889.1; Neumayer, L. 1913.1; Pantanelli, D. 1904.2; Pascoe, E. H. 1909.1; ★Priem, F. 1906.1, 1911.2, 1912.2, 1913.1, 1914.1; Schubert, R. J. 1902.1, 1905.1, 1906.2, 3, 1907.1, 1912.1, 2.

Cretaceous otoliths of Germany. Stolley, E. 1906.1, – 1913.1.

OVA AND OVUM

Comprising all non-pelagic eggs.

For all papers relating to the care of their eggs by the parent fishes such as Brood-pouch incubation; Oral gestation; Nest-building; etc., see under Reproduction. For number of eggs produced, see Fecundity, under Reproduction.

For all developmental stages of the ovum, beginning with fertilization, see under Embryology.

For the handling of eggs in fish-culture, artificial fertilization, shipment to foreign countries, etc., see under Pisciculture.

For size of ova see under Oral gestation under Reproduction. Eggs incubated in the mouth of the parent are uniformly large.

Popular general articles on the fish egg. Cunningham, J. T. 1896.1; McIntosh, W. C. 1885.1, 1886.7, 1889.1; Ryder, J. A. 1886.6.

Chemical Composition

Composition of ovum, especially the yolk, in various fishes. Dubuisson, H. 1906.1; Gobley, — 1850.1, 1851.1; Kensington, E. T. 1884.1; Lams, H. 1904.1; Morin, B. 1823.1; Prince, E. E. 1886.2, 1887.2; Retzius, A. J. 1854.1, 1855.1. — *Esox*. Reichert, C. B. 1856.1, 2; Vauquelin, L. N. 1817.1, Add. 1818.1. — *Acanthias*. Zdarek, E. 1904.1.

Physical and chemical changes during maturation. Milroy, T. H. 1898.1.

Protein substances; albumins, globulins, etc., of ovum including its secondary membranes. Alsberg, C. L. & Clark, E. D. 1908.1; Baumhauer, E. 1848.1; Dezani, S. 1908.1; D'yakonov, K. S. 1866.1; Leuchs, J. C. 1862.1; Miyake, K. & Tadokoro, T. 1911.1; Yoshimura, K. 1913.1. — *Klupeovin*. Hugounenq, L. 1904.1. — *Nucleic acid*. Levene, P. A. & Mandel, J. A. 1906.1; Tschernorutzky, H. 1912.1. — *Purin bases*. Linnert, K. 1909.1. — *Percaglobulin*. Mörner, C. T. 1904.1. — *Phosphoglycoproteins; ichthin ichthidin, and ichthulin*. Levene, P. A. 1901.2; ★Valenciennes, A. & Fremy, E. 1854.2; Virchow, R. L. 1853.1.

Egg-cases of sharks; keratin tertiary membranes, constitution. Buchtala, H. 1908.1; Hussakof, L. & Welker, W. H. 1908.1, 1911.1; Krukenberg, C. F. 1885.1; Pregl, F. 1908.1. — *Comparison with egg capsule of snake*. Krukenberg, C. F. Add. 1882.3, 4.

Egg-cases or Horn-like Membranes

Cyclostomata. Hooked capsules, probably secondary or follicular membranes.

Bdellostoma. ★Dean, B. 1899.6; Doflein, F. J. 1899.3; Plate, L. H. 1896.1.

Myxine. Cunningham, J. T. 1887.4, 5, 1897.1; Dean, B. 1900.2, 1903.3, 1904.7; Jensen, A. S. 1900.1; Klinckowström, A. 1895.1; Steenstrup, J. J. 1863.2, 1864.2. — *Development within follicle*. Cunningham, J. T. Add. 1886.1.

Elasmobranchii. Keratin egg-cases, a tertiary membrane secreted by nidamental gland of oviduct.

For homologue of the egg-case in viviparous forms, see Foetal membranes below

Viviparity under Reproduction. For Chemical composition, see above.

See also Oviposition of shelled eggs of *Selachii* and Oviparity of *Elasmobranchii* under Reproduction.

Manner of formation with structure of nidamental gland, etc. Borcéa, J. 1904.5; Gerbe, Z. 1872.1, 2; Henneguy, L. F. 1893.2; Perravex, E. 1884.1; ★Widakowich, V. 1905.1, 1906.1; Wyman, J. 1859.2, 3. — *Osmotic permeability*. Dakin, W. J. 1911.1, 2; Peyréga, E. 1914.1. — *Orientation in oviduct*. Vaillant, L. L. 1884.1; Widakowich, V. 1908.2.

Batoidei; egg-cases and ova of rays, chiefly Raja. Boldo, B. M. 1797.1; Holt, E. W. 1897.1; Phipson, T. L. 1874.1; Putnam, F. W. 1870.8, 1872.9; Schenk, S. L. 1874.2; Williamson, H. C. 1912.1; Anon. 462. — *Early refs., Pre-Linn. section*. Needham, J. T. 1745.1; Paullini, C. F. 1701.1.

Selachii; eggs and egg-cases of various sharks. Agassiz, J. L. 1873.1; Tilesius von Tilenau, W. 1802.1; Troschel, F. H. 1874.1; Vávra, V. Add. 1901.1. — *Hep-tanchus*. Braus, H. 1906.4. — *Scyllium*. Couch, J. 1844.3; Portlock, J. E. 1845.1, 2; Thompson, W. 1844.2. — *Ginglymostoma*. Gudger, E. W. 1913.1, Add. 1912.2. — *Stegostoma*. Vaillant, L. L. 1878.1. — *Heterodontus*. ★Waite, E. R. 1896.1.

Two ova in a single egg-case, a teratological condition. Joseph, H. 1906.1; Vaysière, A. 1909.1.

So-called "wind-eggs" (of *Elasmobranchii*) are also known where the egg-case is formed when no egg is present as in similar cases in birds.

Holocephali. Egg-capsules of *Chimaeridae*. Agassiz, J. L. (*Callorhynchus*) 1873.1; ★Dean, B. 1904.1, 2, 6, 9, 1906.1, 1912.6; Prince, E. E. 1897.1.

Fossilized remains of egg-cases of *Chimaeroids*. — *Jurassic of Württemberg*. Bes-sels, E. 1869.1; Jaekel, O. 1896.1, 1901.1. — *of Spain*. Sauvage, H. E. 1905.2. — *of France*. Leriche, M. Add. 1914.1. — *Cretaceous of America*. Dean, B. 1909.5; Gill, T. N. 1905.3.

Egg-membranes of Teleostei

For the most valuable "Historical and critical review of the literature on the primary egg membranes and the micropyle in fishes," inclusive of all groups, see ★Mark, E. L. 1890.1.

General papers. Lanzi, L. 1909.1, 3, 1910.1; ★Mark, E. L. 1890.1; Müller, J. 1854.1; Ovsyannikov, F. V. 1885.1; Scharff, R. F. 1886.1; ★Eigenmann, C. H. Add. 1890.2.

Vitelline or primary membrane. Hogg, J. 1855.2; ★Lallinger, J. 1901.1; Stockmann, R. 1883.1.

Follicular or secondary membrane. Retzius, M. G. 1912.1.

Factors governing permeability by sperm. Brown, O. H. 1905.1; Newman, H. H. 1905.1.

Softening of membranes by digestive fer-

ment at time of hatching. Kerr, G. 1900.1; Wintrebert, P. 1912.1,2.

Micropyle. *Structure, etc.* André, J. 1875.1; Bruch, C. W. 1856.1; Buchholz, R. W. (*Osmerus*) 1863.1; Ransom, W. H. 1855.1, 1867.1; Reichert, C. B. 1856.1; Ryder, J. A. (*Morone*) 1882.5; Siebold, C. T. 1856.1. — *Record of discovery* (*Syngnathus*). Doyère, M. P. 1849.1. — *Multiple micropyles in Acipenser*. Murray, A. 1871.1; Zalsenski, V. V. 1878.1.

Ovarian Ovum

Histological structure. *Including deposition and microscopic structure of yolk.* Auerbach, L. 1891.1; Calderwood, W. L. 1892.1; Comes, S. 1905.2, 1906.1; ★Cunningham, J. T. 1893.1, 1897.3, 1898.1; Franz, V. 1910.6; His, W. 1873.1; Scharff, R. F. 1888.1; Solger, B. F. 1885.1; ★Wallace, W. 1903.1. — *Dipnoi*. Beddard, F. E. 1887.1,2,3. — *Gasterosteus*. Beale, L. S. 1867.1; Ransom, W. H. 1867.3.

Yolk-nucleus or vitelline body. (*Dotterkern, corps vitellin, nucleus of Balbiani, etc.*) Bambeke, C. 1873.1, 1874.1, 1883.1; Franz, V. 1907.5 (*Pleuronectes*); ★Henneguy, L. F. 1893.1, Add. 1887.1; Hubbard, J. W. 1903.1 (*Cymatogaster*); Kastschenko, N. 1888.2, 1890.1; Stéphan, P. 1901.2, 1902.6; Wallace, W. 1903.1.

Oögenesis and maturation of ovum. *General treatises.* ★Hertwig, R. 1903.1; Rabl, C. 1915.1; Jörgensen, M. Add. 1913.1.

Oögenesis in Amphioxus. Maréchal, J. 1907.1; Sobotta, J. 1897.2; Stricht, O. 1896.1.

Cyclostomes — Myxine. Cunningham, J. T. 1887.4. — *Petromyzon.* Böhm, A. 1888.1; Calberla, E. 1877.1; Herfort, K. V. 1893.1, 1900.1.

Elasmobranchii. Cerruti, A. 1905.1, 1908.1; Kastschenko, N. 1890.1; Ludwig, H. J. 1875.1; Maréchal, J. 1907.1; Maréchal, J. & Saedeleer, A. 1910.1; ★Rückert, J. 1892.1; Schmidt, A. H. 1898.1.

Teleostei. Balbiani, E. J. 1873.1, 1879.1; Fulton, T. W. 1898.1,2,3; Kolessnikow, N. 1878.1; ★Maréchal, J. 1904.1–1907.1. — *Salmo.* Behrens, G. 1898.1; Blanc, H. 1891.1, 1892.1, 1894.1. — *Lebias.* Mazza, F. 1901.3.

Halving of somatic number of chromosomes during maturation, nature of reduction division, etc. Bambeke, C. 1893.1; Moore, J. E. 1894.1; Nusbaum, J. 1913.1; Rückert, J. 1893.1; Rohde, E. Add. 1911.1.

For the Origin and migration of the germ cells, see under Embryology.

Pelagic or Planktonic Ova

Since the literature of this subject cannot be readily disassociated from that relating to larval fishes, it has been placed under Planktonic fauna, which see.

Various Teleostean Ova

Special papers with descriptions of eggs of — Osmerus. Cunningham, J. T. 1886.1.

— *Anchovy (size of egg).* Dietz, P. A. 1908.1. — *Gobius.* Guitel, F. 1892.3; Meek, A. 1903.3; Retzius, M. G. 1911.2. — *Lepadogaster.* Guitel, F. 1887.1. — *Lebias.* Lepori, C. 1881.1. — *Agonus and Blennius.* McIntosh, W. C. 1885.4, 1903.1. — *Atherina.* Pagenstecher, H. A. 1861.1. — *Lota.* Prince, E. E. & Halkett, A. 1906.1; Wesenberg-Lund, C. J. 1909.1. — *Crystallogobius.* Raffaele, F. 1895.2. — *Stizostedion.* Reighard, L. E. 1893.2. — *Menidia.* Ryder, J. A. 1883.2. — *Sparus and Sebastes.* Williamson, H. C. 1911.4.

For fixed ova or eggs arranged and cared for by parents, see Nest-building under Reproduction.

Descriptions of pelagic Teleostean ova will be found under Planktonic fauna.

For structure of the eggs of Cyclostomata, and Elasmobranchii, see above under Egg-cases.

PALAEONTOLOGY

General Treatises

Text in English. *Zittel's Text-book of Palaeontology.* ★Eastman, C. R. 1902.10; *A Manual of Palaeontology, etc.* ★Nicholson, H. A., & Lydekker, R. 1889.1; *Outlines of vertebrate palaeontology, etc.* ★Woodward, A. S. 1898.7. — *Encyc. arts.*: Marsh, O. C. 1895.1; Osborn, H. F. 1911.1.

Popular treatises: Creatures of other days. Hutchinson, H. N. 1894.1; *Extinct animals,* Lankester, E. R. 1905.1; *The origin and evolution of life,* Osborn, H. F. 1916.1; *The young collector's handbook of fossils,* Woodward, B. B. 1885.1; *Animals of the past,* Lucas, F. Add. 1901.1; *Animals before man in America,* Lucas, F. A. Add. 1902.1; . . . *Introduction to the study of fossil organic remains,* Parkinson, J. Add. 1822.1.

Text in French. *Les enchaînements du monde animal dans les temps géologiques,* Gaudry, J. A. 1883.1, 1890.1; *Traité élémentaire de paléontologie,* Pictet, F. J. 1844.1; *Traité de paléontologie,* Zittel, K. A. 1893.1. — *Encyc. arts.*: Blainville, H. M. D. 1808.2; Sauvage, H. E. Add. 1869.1.

Text in German. *Grundzüge der Paläobiologie der Wirbeltiere,* Abel, O. 1912.1; *Fauna der Vorwelt,* Giebel, C. G. 1847.1; *Thiere der Vorwelt,* Keller, G. 1901.1; *Elemente der Paläontologie,* Steinmann, J. H., & Döderlein, L. 1890.1; *Lehrbuch der Paläozoologie,* Stromer, E. 1909.1; *Aus der Urzeit,* Zittel, K. A. 1875.1; *Grundzüge der Paläontologie, Ibid.* 1895.1, 1911.1; *Handbuch, Ibid.* 1887.1; *Paläontologie und Paläozoologie,* Abel, O. Add. 1914.1; *Elemente der Paläontologie,* Hoernes, R. Add. 1884.1. — *Encyc. arts.*: Blainville, H. M. D. 1823.1; Pompeckj, J. F. 1913.1.

Text in Russian. Trautschold, H. von. 1875.1.

Text in Spanish. Landerer, J. J. 1878.1.

Text in Swedish. Sederholm, J. J. 1916.1.

Palæontology — *Cont'd.*

Special Articles

The relations of the horizons of extinct vertebrata of Europe and North America, Cope, E. D. 1879.5; *First calcareous fossils, etc.*, Daly, R. A. 1910.1; *Ancient fauna compared with present day fishes*, Giebel, C. G. 1848.1; *Recueil des monumens des catastrophes*, Knorr, G. W., & Walch, J. E. 1768.1; *The progress of vertebrate palæontology in Canada*, Lambe, L. M. 1904.1, 1904.2; *The past vertebrate life of Canada*, Lambe, L. M. 1912.2; *Illustrations of antediluvian zoology*, Taylor, R. C. 1830.1; *The imperfection of the geological record*, Woodward, A. S. 1898.2; *Relations of palæontology to biology*, Woodward, A. S. 1906.7; *The study of fossil fishes*, Woodward, A. S. 1906.8; *The use of fossil fishes in stratigraphical geology*, *Ibid.* 1915.2; *Palæontology and the biogenetic law*, Zittel, K. A. 1895.2.

History. *History of instruction in German universities*, Eastman, C. R. 1894.2; *La géologie antique, etc.*, Schvarcz, G. 1861.1; *History of Scottish fossil ichthyology*, Traquair, R. H. 1880.1; *History to end of 19th century*, Zittel, K. A. 1899.1, 1908.1.

Geology. General treatises, textbooks, etc., with incidental references to fossil fishes.

Text in English. Dana, J. D. 1863.2, 1866.1, 1875.1, 1880.1, 1895.1; Le Conte, J. 1878.1–1905.1; Mantell, G. A. 1838.1–1850.1; Miller, H. 1857.1; Miller, S. A. 1889.1; Phillips, J. 1837.1; ★Pirsson, L. V., & Schuchert, C. 1915.1; Scott, W. B. 1897.1.

Text in French. Bertrand, E. 1766.1. ★Haug, E., 1908.1; Lapparent, A. A. 1881.1–1906.1; Launy, L. de. 1905.1, 1913.1.

Text in German. Kayser, F. H. 1913.1; Lepsius, C. G. R. 1887.1, 1903.1.

Collections, Exhibitions, Type-Specimens, etc. For palæontological material in particular collections and institutions, see under Museums.

Early references to fossil fishes, bufo-fonites, glossopetræ (sharks' teeth), etc. in Pre-Linn. section.

Aldrovandi, U. 1648.1; Armstrong, J. 1752.1; Bartholinus, C. 1704.1; Besler, B. 1716.1; Boccone, P. 1670.1; Boodt, A. B. 1609.1; Brückmann, F. E. 1742.1; Buonammi, F. 1709.1; Charleton, G. 1668.1; Columna, F. 1606.1; Evelyn, J. 1668.1; Fischer, C. G. 1714.1; Geyer, J. 1687.1; Gimma, G. 1730.1; Imperato, F. 1628.1; Jussieu, A. 1723.1; Kentman, J. 1565.1; Kircher, A. 1678.1; Knorr, G. W. 1754.1; Koenig, E. 1690.1; Luid, E. 1693.1; Major, D. B. 1704.1; Mylius, G. F. 1709.1; Nuenning, J. H. 1746.1; Petiver, J. 1706.1; Ray, J. 1673.1; Steno, N. 1669.1; Stobæus, J. 1738.1; Swammerdam, J. 1679.1; Torrubia, F. J. 1754.1; Valentini, M. B. 1708.1; Woodward, J. 1728.1; Worm, O. 1686.1.

PALÆONTOLOGY BY REGIONS

General

Recherches sur les poissons fossiles. 5 vols. ★Agassiz, J. L. 1833.2. — *Catalogue of the fossil fishes in the British Museum*. 4 vols. ★Woodward, A. S. 1889.2 — *Reviews of this work*: Cope, E. D. 1891.1; Zittel, K. A. 1896.1.

America, North. *Bibliography and catalogue of the fossil vertebrata of North America*. ★Hay, O. P. 1902.1.

British organic remains, inclusive of fossil fishes. *Catalogues*: Morris, J. 1843.1; ★Woodward, A. S., & Sherborn, C. D. 1890.1, 1891.1. *Stratigraphical list*: Tennant, J. 1847.1, 1858.1. *Synoptical tables*: ★Agassiz, J. L. R. 1843.3; Woodward, S. 1830.1.

France. *Paléontologie de la France*. Archaic, E. J. 1868.1; *Zoologie et paléontologie française, etc.* 2 vols. Gervais, F. L. 1848.2, 1859.2.

Germany. *Index Palæontologicus*. Goeppert, H. R., & Meyer, H. 1848.1; *Petrefacta Germaniæ*. Goldfuss, G. A. 1826.1.

Italy. *Bibliografia mineralogica geologica e palæontologica della Toscana*. Achiardi, A. d'. 1875.1; *Enumération des poissons fossiles d'Italie*. Agassiz, J. L. R. 1840.1; *Ittiologia fossile Italiana*. Costa, O. G. 1855.2, 1857.2.

Stratigraphical Arrangement of the Fossil Fish-Fauna of the World, with emphasis on particular localities where fish-bearing strata are exposed.

In general, statements of the authors are taken as authority for references to the particular periods. Where conflicts in opinion occur, the weight of evidence is considered to be in favor of the later paper and the references are so arranged.

In some cases, this arrangement becomes necessarily empirical. The age or period will generally be found in accord with Woodward, A. S., "Catalogue of . . . British Museum" (1889.2) and Hay, O. P., "Bibliog. and Cat." (1902.1), when the papers are comprised in these works.

PALÆOZOIC (ERA)

The Palæozoic fishes of North America. ★Newberry, J. S. 1889.1. — *Reviews of this work*: Cope, E. D. 1890.2; Jaekel, O. 1893.1; *American Palæozoic fossils, catalogue of genera and species*. Miller, S. A. 1877.1; *Classification of Palæozoic fishes*. Rohon, J. V. 1896.1; *Lists of Palæozoic fishes*: (British) Barkas, W. J. 1874.3; Etheridge, R. 1881.1; *Adaptive radiations*. Abel, O. 1907.1.

ORDOVICIAN (Lower Silurian)

North America

Colorado: *Harding sandstone at Canyon City*. Walcott, C. D. 1891.1, 2, 1892.1. — *Remarks on these discoveries*: Clark, J. M. 1895.1; Cockerell, T. D. 1913.2 (considered to be Devonian); Jaekel, O. 1892.1, 1895.1; Vaillant, L. L. 1902.4; **Wyoming, Bighorn Mts.** Darton, N. H. 1906.1.

SILURIAN**North America**

Canada: *New Brunswick.* Matthew, G. F. 1886.1-1901.1; *Nova Scotia.* Whiteaves, J. F. 1898.1. **United States:** *Pennsylvania.* Claypole, E. W. 1884.1, 3, 4, 5, 1885.1, 1891.1.

Europe

Austria-Hungary: *Bohemia.* Barande, J. 1872.1, 2; *Galicia.* Alth, A. 1882.1-1886.2; Schmidt, Fried. 1873.3. **Belgium:** *Condruz.* Destinez, P. 1904.1. **British Is.:** **England** (*Ludlow series*). Etheridge, R. Add. 1888.1 (*List*); *Hereford Co.* Banks, R. W. 1856.1; Harley, J. 1861.1; Woodward, A. S. 1904.3; *Salop Co. or Shropshire.* Agassiz, J. L. R. 1839.1; Egerton, P. M. G. 1848.3; Elles, G. L., & Slater, I. L. 1906.1; Hinde, G. J. 1904.1; Mackie, S. J. 1861.1; Murchison, R. I. 1837.1; 1839.2, 1853.1, 1857.1; Salter, J. W. 1851.1, 1859.1, 1867.2; *Worcester Co., Malvern.* Phillips, J. 1848.1. **Scotland:** Peach, B. N., & Horne, J. 1899.1; Smith, John. 1907.2; Traquair, R. H. 1899.3, 1905.2; (*Remarks on 1899.3*); Claypole, E. W. 1900.1; Armstrong, J. Add. 1871.1 (*catalogue*). **Germany:** *Mecklenburg-Schwerin, Rostock.* Geinitz, H. B. 1884.1; *West Prussia, Dantzig.* Kiesow, J. 1885.1. **Norway:** *Kristiania.* Kiær, J. 1911.1. **Portugal:** Priem, F. 1911.3. **Russia:** *Oesel I.* ★Pander, C. H. 1856.1; Rohon, J. V. 1892.2, 1893.1, 1894.2; Schmidt, Fried. 1866.1, 1893.1, 1894.1; Eichwald, C. E. Add. 1854.1; *St. Petersburg Gov't.* Rohon, J. V. 1889.3. **Sweden:** *Gotland I.* Lindström, G. 1894.1-1896.1.

Oceanica

Australia: *Victoria.* Chapman, F. R. 1906.1.

DEVONIAN

Systematic arrangement of Devonian fishes. Huxley, T. H. 1861.3.

North America

Canada: *Manitoba.* Whiteaves, J. F. 1892.1.—*New Brunswick, Campbellton.* Traquair, R. H. 1890.2, 1893.2; Whiteaves, J. F. 1881.2, 1887.1; Woodward, A. S. 1892.8.—*Nova Scotia, Knoydart formation.* Ami, H. M. 1901.1.—*Ontario (Prov.)* Lennox, T. H. 1886.1; Whiteaves, J. F. 1898.2.—*Quebec (Prov.), Baie des Chaleurs.* Cope, E. D. 1881.2; Whiteaves, J. F. 1880.1.; *Gaspé.* Lankester, E. R. 1870.2, 4; Dawson, J. W. Add. 1858.1; *Scaumenac Bay.* Hussakof, L. 1912.4; Traquair, R. H. 1890.2, 1893.2; Whiteaves, J. F. 1881.3, 1882.1, 1887.1, 1907.2; Woodward, A. S. 1892.6, 1900.6.

Greenland: Woodward, A. S. 1901.1.

United States: **Colorado.** Cockerell, T. 1913.2; Eastman, C. R. 1904.9, 1915.2; Hay, O. P. 1900.1, 1902.2. **Illinois.** Eastman, C. 1899.1; Hay, O. P. 1900.1; Udden, J. A. 1897.1, 1899.1; Weller, S. 1899.1. **Indiana.** Norwood, J. & Owen;

D. 1846.1, 2. **Iowa.** Arey, M. F. 1906.1. ★Eastman, C. R. 1897.4, 1903.3, (*General treatise*) 1908.1; Lindahl, J. 1897.1. **Maryland.** Swartz, C. K. 1913.1. **Missouri.** Branson, E. B. 1914.1; Weller, S. 1906.1. **New York.** Bradley, F. H. 1866.1; Clarke, J. M. 1885.1, 1893.1, 1903.1; ★Eastman, C. R. 1899.5, (*General treatise*) 1907.1; Hinde, G. J. 1879.3; Kindle, E. M. 1896.1; Newberry, J. S. 1884.1; Ringueberg, E. N. 1884.1; Smith, B. 1909.2, 1910.1; Van Ingen, G., & Clark, E. 1903.1; Williams, H. S. 1882.1; Williams, H. U. 1886.1; Butts, C. Add. 1903.1. **Ohio.** Brainerd, J. 1852.1; Branson, E. B. 1908.2-1911.1; Claypole, E. W. 1888.1-1903.1; Dean, B. 1893.2, 1898.1, 1901.4, 1911.1; Hallock, C. 1873.4; Hitchcock, C. H. 1868.1, 2; Hussakof, L. 1905.1-1911.1; ★Newberry, J. S. 1857.1, 3, 1868.2, 1870.1, 1873.1, 1874.1, 1883.2, 3, 1885.1, 2, 1887.2, 1889.1; Stauffer, C. R. 1909.1. **Pennsylvania.** Claypole, E. W. 1883.1, 2, 1884.2; Cope, E. D. 1892.5; Hay, O. P. 1900.1; Leidy, J. 1858.1; Lesley, J. P. 1889.1; Hall, J. Add. 1843.1. **Wisconsin.** Cleland, H. F. 1911.1; Eastman, C. R. 1899.2; Lapham, I. A. 1859.1; Newberry, J. S. 1877.1; Teller, E. E. 1911.1.

South America

Brazil: *Amazonas, Rio Maecurú.* Katzer, F. 1897.1.

Asia

Siberia: *Yeniseisk (Govt.) (Jenissei).* Rohon, J. V. 1889.2, 1890.2.

Europe

Austria-Hungary: *Bohemia.* Barande, J. 1872.1, 2; Koenen, A. 1895.1; *Settenz near Teplitz.* Raffelt, R. 1877.1; *Lower Austria, Hütteldorf.* Redlich, K. A. 1896.1.

Belgium: Beneden, P. J. 1869.2, 1870.2; Beneden, P., & Koninck, L. 1864.1; Cope, E. D. 1892.1; Dollo, L. 1913.1; Dormal, V. 1887.1; Firket, A. 1874.1; Fourmarier, P. 1899.1; Fraipont, C. 1908.1, 1912.1; Koninck, L. 1878.1; Leriche, M. 1912.3 (*Dour*); Lohest, M. 1881.1-1890.1; Maillieux, E. 1909.1; Malaise, C. 1887.1 (*Namur*); Stainier, X. 1894.1.

British Is.: *Old Red Sandstone.* — *Monographs.* ★Agassiz, J. 1844.3; ★Powie, J., & Lankester, E. 1868.1; ★Traquair, R. H.: 1894.2, 1904.1, 1906.1.—*Popular treatises.* Bigsby, J. J. 1878.1; Lankester, E. R. 1864.1; Miller, H. 1841.1, 1859.1; Etheridge, R. Add. 1888.1 (*List*). **England:** **Cornwall** (Co.). Fox, H. 1900.1; Lankester, E. R. 1868.1; Peach, C. W. 1846.1, 1868.1; Pengelly, W. 1849.1-1868.1; Symonds, W. S. 1868.1, 1872.1; Woodward, A. S. 1901.2 (*Looe*); Woodward, H. 1868.1; Wyatt-Edgell, E. 1868.1. **Devon** (Co.). Hamling, J. G. 1908.1; Lankester, E. R. 1868.1; Pengelly, W. 1849.1-1868.1; Symonds, W. S. 1868.1; Woodward, H. 1868.1; Wyatt-Edgell, E. 1868.1. **Durham** (Co.). Hut-

Palæontology — *Cont'd.*

ton, W. 1831.1. **Hereford** (Co.), *Old Red Sandstone*. Lankester, E. R. 1861.1, 2; Symonds, W. S. 1859.1; Woodward, A. S. 1888.7 (*Ledbury*). **Nottingham** (Co.), *Mansfield*. Sweet, G. 1890.1. **Salop** (Co.), *Farlow*. Egerton, P. 1862.1. **Somerset** (Co.), *Portishead*. (*Old Red Sandstone*). Baily, W. H. 1864.1; Gardiner, E. 1892.1; Williams, D. 1842.1. **Orkney Is.** (*Old Red Sandstone*). Flett, J. S. 1898.1; Traill, T. S. 1841.1, 1845.1. **Scotland**. (*Old Red Sandstone*). Agassiz, J. 1834.4, 1839.2, 1842.2, 1843.1, 1846.3; Ibbetson, G. A. 1867.1; M'Coy, F. 1848.2; Malcolmson, J. G. 1838.1, 1842.1; Murchison, R. I. 1839.1; O'Connell, M. 1916.1; Pander, C. H. 1857.1, 1858.1, 1860.1; Pengelly, W. 1862.1; Roberts, G. E. 1852.1; Traquair, R. H. 1901.3 (*List*).—*Argyll* (Co.), *Oban*. Traquair, R. H. 1899.1.—*Berwick* (Co.), *Earlston*. Goodchild, J. G. 1905.1.—*Caithness* (Co.), *Achanarras quarry*. Peach, C. W. 1859.1, 1867.1; Traquair, R. H. 1890.7, 1892.1, 1893.6, 1894.1, 5; Sedgwick, A., & Murchison, R. Add. 1835.1.—*Cromarty* (Co.). Miller, H. 1842.1.—*Edinburgh* (Co.). Jameson, R. 1837.1.—*Elgin* (Co.). Owen, R. 1841.2; Roberts, G. E. 1864.1.—*Fife* (Co.), *Dura Den*. Anderson, J. 1837.1; Anderson, John 1859.1, 1860.1, Add. 1859.1; Mitchell, H. 1863.2; Traquair, R. H. 1892.3; Walker, R. 1863.1; Woodward, A. S. 1915.1.—*Forfar* (Co.). Mitchell, H. 1885.1; Newton, E. T. 1892.1; Powrie, J. 1860.1–1870.1; Traquair, R. H. 1899.2.—*Moray* (Co.). Taylor, W. 1908.1; Traquair, R. H. 1894.6, 1896.2, 1897.1, 1904.3.—*Roxburgh* (Co.), *Melrose*. Peach, C. W. 1874.1. **Shetland Is.** Traquair, R. H. 1908.1.—**Wales**, *Breconshire*, *Hay*. Symonds, W. S. 1871.1.

France: *Mayenne* (Dept.). Bézier, T. 1913.1.—*Pas-de-Calais* (Dept.). Barrois, C. 1874.1, 1875.1; Dorlodot, H. 1912.1, 2; Gosselet, J. A. 1903.1; Leriche, M. 1903.1, 2, 1906.1, Add. 1912.1.—*Saône-et-Loire* (Dept.). Landriot, — 1849.1, 1850.1.

Germany: *Prussia*: *Hesse-Nassau*, *Bicken near Herborn*. Koenen, A. 1883.1, 1895.1.—*Rhine Prov.*, *Eifel chalk*. Agassiz, J. L. 1846.6; Eastman, C. R. 1900.6, 1901.1; Huene, F. 1900.1, 2; Jaekel, O. 1899.1; Meyer, C. E. 1851.3, 1855.1, 1859.1; Roemer, C. F. 1856.1; Holzappel, E. Add. 1910.1; *Gerolstein*. Beyrich, H. E. 1877.1; Kayser, F. H. 1880.1; Koenen, A. Add. 1886.1; Lee, J. E. Add. 1882.1; *Gemünden*. ★Traquair, R. H. 1896.4, 1902.4, 1903.2, 1905.3.—*Silesia* (Prov.). Kade, G. 1858.1.—*Waldeck* (Princip.), *Wildungen*. Jaekel, O. 1903.5, 1904.1, 1906.3, 1907.1; Koenen, A. 1883.1.—*Westphalia*. Schlüter, C. 1867.1, 1888.1.—*West Prussia*, *Dantzic*. Klein, J. T. 1770.1.—*Harz Mts.* Kayser, F. H. Add. 1878.1.

Russia: ★Agassiz, J. L. 1844.3, Add. 1845.1; Pander, C. H. 1857.1, 1858.1, 1860.1; Rohon, J. V. 1889.1, 1900.1.—

Archangel (Govt.), *Petchora* (Dist.). Keyserling, A. Add. 1846.1.—*Livonia*. Asmuss, H. 1839.1; Doss, C. B. 1898.1; Grevingk, C. C. 1861.1; Kutorga, S. S. 1835.1.—*Novgorod* (Govt.). Eichwald, C. E. Add. 1840.1.—*Orel* (Govt.). Fischer von Waldheim, G. 1852.1.—*Voronezh* (Govt.), *Slawanka near Pavlovsk*. Eichwald, C. E. 1844.1–1853.1.—*Tula* (Govt.). Trautschold, H. 1874.1, 1876.1.

Spitzbergen: Lankester, E. R. 1884.1; Woodward, A. S. 1891.2, 1900.4, Add. 1889.2.

Oceanica

Australia: *New South Wales*. Etheridge, R. 1906.1.

CARBONIFEROUS

Animals of the Coal Measures. Miall, L. C. 1878.4.

Africa

Madagascar I.: Woodward, A. S. 1910.4. **Natal**; *Ecce shales*. Hatch, F. H. 1910.1; Woodward, A. S. 1910.1. *Somkele*. Woodward, A. S. Add. 1907.1. **Nyasaland**. Traquair, R. H. 1910.1.

North America

Canada: *New Brunswick*: *Albert coal mine in Hillsborough*. Dawson, J. W. 1866.1, 1877.1, 1878.1; Egerton, P. 1853.1; Jackson, C. T. 1851.1–1854.2; Lambe, L. M. 1909.2, 1910.1.—*Nova Scotia*. Dawson, J. W. 1866.1, 1878.1; Whiteaves, J. F. 1881.1, 1898.1; (*Joggins mines*). Bell, W. A. Add. 1913.1.

United States: **Alabama**. Tuomey, M. 1858.1. **Idaho**. *Montpelier*. Hay, O. P. 1907.2. **Illinois**. Branson, E. B. 1905.1; Cope, E. D. 1897.2; Eastman, C. R. 1902.1, 2, 7, (*Mazon creek, list*) 1903.1; Hay, O. P. 1895.1; Hitchcock, E. H. 1855.2; Leidy, J. 1860.2; Newberry, J. S. 1868.1, 1887.1, 1888.2, 4; Newberry, J. S., & Worthen, A. 1866.1, 1870.1; St. John, O., & Worthen, A. 1875.1, 1883.1; Worthen, A. H. 1856.1. **Indiana**. Branson, E. B. 1905.1, 1906.1; Eastman, C. R. 1903.1; Hitchcock, E. H. 1855.1, 1856.1; Kindle, E. M. 1898.1 (*List*); Newberry, J. S. 1879.1, 1884.2. **Iowa**. Branson, E. B. 1905.1; Eastman, C. R. 1908.2; Hay, O. P. 1912.1; Keyes, C. R. 1888.1, 1891.1; Savage, T. E. 1903.1. **Kansas**. Beede, J., & Rogers, A. 1906.1; Eastman, C. R. 1902.9; Leidy, J. 1860.7; Moodie, R. L. 1915.2; Twenhofel, W., & Dunbar, 1914.1; Williston, S. W. 1899.2. **Kentucky**. Newberry, J. S. 1868.1. **Missouri**. Eastman, C. R. 1902.9, 1903.1; Leidy, J. 1860.2; *Catalogues*. Hambach, G. 1890.1; Keyes, C. R. 1894.1. **Nebraska**. Eastman, C. R. 1902.9; St. John, O. H. 1870.1, 1872.1. **Nevada**. Dean, B. 1897.3. **New Mexico**. Newberry, J. S. 1876.1; Williston, S., & Case, E. 1912.1. **Ohio**. *Linton coal measures of Jefferson Co.* Cope, E. D. 1873.2, 1874.1, 1897.2; Newberry, J. S. 1853.1, 2, 1856.1, 1868.1, 1873.4, 1874.2. **Oklahoma**. Snider, L. C. 1915.1. **Pennsyl-**

vania. Cope, E. D. 1886.1, 1897.2; Lea, I. 1853.1; Leidy, J. 1858.1; Lesley, J. P. 1889.1. **Texas.** Udden, J., & Phillips, D. 1912.1. **Virginia.** Egerton, P. 1847.1.

South America

Argentina: Tornquist, A. 1904.1.

Asia

India: *Punjab (Prov.), Productus limestone of Salt Range.* Koken, E. 1901.1; Koninck, L. G. Add. 1863.1; Waagen, W. Add. 1880.1.

Europe

Belgium: Boulenger, G. A. 1899.1, 1902.20 (*Denée*); Cornet, J. 1906.1; Destinez, P. 1897.1, 1902.1; Dewalque, G. 1877.1, 1878.1; Fraipont, J. J. 1889.1; Koninck, L. 1842.1; Stainier, X. 1905.1.

British Is.: *General treatise.* ★Davis, J. W. 1883.1.—*Misc. and Gen.* Bigsby, J. J. 1878.1; Davis, J. W. 1893.1, 1894.1; Hind, W. 1902.1; Hind, W., & Howe, J. 1901.1; Hind, W., & Stobbs, J. 1906.1; *List.* Etheridge, R. Add. 1888.1. **England:** **Chester (Co.).** Ward, J. 1906.1; Ward, J., & Stobbs, J. 1906.1; Wedd, C. B. 1906.1. **Cornwall (Co.).** *Polperro.* M'Coy, F. Add. 1851.1. **Derby (Co.).** Davis, J. W. 1886.1; Fox-Strangways, C. 1905.1; Jackson, J. W. 1908.1; M'Coy, F. 1848.1; Wilson, E. 1880.1. **Durham (Co.).** Kirkby, J. W. 1864.1; Kirkby, J., & Atthey, T. 1864.1. **Gloucester (Co.).** *Bristol coalfield.* Bolton, H. 1907.2, 1911.1; Heath, A., & Morgan, C. 1893.1; Reynolds, S. H. 1908.1. **Lancaster (Co.).** *Lancashire coal measures.* Binney, E. W. 1840.1; Bolton, H. 1895.1–1907.1, Add. 1890.1, 1905.1; Davis, J. W. 1891.1; Parker, W. A. 1904.1, 1908.1; Sherlock, R. L. 1915.1; Williamson, W. C. 1837.1–1842.1. **Northumberland (Co.).** *chiefly Newsham colliery near Newcastle-upon-Tyne.* Atthey, T. 1867.1–1875.1; Barkas, T. 1868.1–1881.1, *General treat.* 1873.1; Barkas, W. 1874.4; Hancock, A., & Atthey, T. 1868.1–1872.1; Howse, R. 1890.2; Kirkby, J., & Atthey, T. 1864.1; Owen, R. 1867.1, 2; Stock, T. 1880.2. **Salop (Co.).** *or Shropshire.* Morris, J., & Roberts, G. 1862.1, 1864.1. **Stafford (Co.).** Egerton, P. 1835.1, 1866.1; Newton, E. T. 1904.1; Stobbs, J. T. 1905.1; Traquair, R. H. 1874.1; Ward, J. 1870.1, 1904.1, 1905.1. **York (Co.).** *"Millstone Grit."* Aitken, J. 1874.1–1876.2; Davis, J. W. 1871.1–1880.3, 1882.1, 1884.3, 5, Add. 1879.1, 1890.1; Miall, L. C. 1872.1, 1879.1; Painter, W. H. 1873.1, 1874.1; Wellburn, E. D. 1898.1–1907.1; Williamson, W. C. 1842.1; Wilson, G. V. 1910.1; Woodward, A. S. 1900.7, 1916.2; Drake, H., & Sheppard, T. Add. 1910.1; Miall, L. C. Add. 1884.1. **Ireland:** *Armagh Limestone and Cultra, Co. Down.* Davis, J. W. 1882.2, 1890.1; M'Coy, F. 1848.1.—*Fermanagh (Co.).* Portlock, J. E. Add. 1843.1.—*Kilkenny (Co.).* Bolton, H. 1895.3; Traquair, R. H. 1893.4; Baily, W. H. Add. 1878.1. **Scotland:** Agassiz, L. J. 1834.4; Hinde, G. J. 1900.1; Peach, B., & Horne, J. 1904.1,

1905.1; Smith, John, 1900.1; *Catalogue.* Armstrong, J. Add. 1871.1.—*Clackmannan (Co.).* Fleming, J. 1835.1.—*Dumfries (Co.).* *Eskdale.* Traquair, R. H. 1881.4, 1884.1, 2.—*Edinburgh (Co.).* Conybeare, W. D. 1834.1; Hibbert, S. 1834.1, 1845.1; Kinnear, W., & Anderson, W. 1883.1; Somervail, A. 1872.1; Traquair, R. H. 1875.1, 1877.2, 1879.2, 1903.3; *Blackband ironstone of Borough Lee.* Traquair, R. H. 1881.1, 2, 1882.2, 1883.1, 1884.4, 1890.3.—*Fife (Co.).* Binney, E., & Kirkby, J. 1882.1; Horner, L. 1845.1; Kirkby, J. W. 1888.1, 1905.1; Traquair, R. H. (*List*) 1890.1, (*Abden bone bed.*) 1886.3, 1897.3, 1901.4, 1905.1.—*Haddington (Co.).* *Gullane.* Traquair, R. H. 1907.2.—*Lanark (Co.).* M'Coy, F. 1848.1; Thomson, J. 1867.1, 1874.2; Traquair, R. H. 1874.2, 1885.1; Young, J. 1867.2, 1870.1; Armour, A. Add. 1867.1; Owen, R. Add. 1853.1.—*Linlithgow (Co.).* Traquair, R. H. 1879.2. **Wales:** Salter, J. W. Add. 1861.1.

France: *Ain (Dept.).* Sauvage, H. E. 1893.3.—*Allier (Dept.).* *Buxière-les-Mines.* Sauvage, H. E. 1875.3.—*Nord (Dept.).* Barrois, C. 1910.1; Leriche, M. 1908.5.—*Saône-et-Loire (Dept.).* Sauvage, H. E. 1891.5.

Germany: *Baden (Grand-D.).* *Lenzkirch.* Gerhardt, K. 1899.1.—*Prussia, Saxony (Prov.).* *Magdeburg.* Wolterstorff, W. G. 1899.1; *Wettin.* Giebel, C. G. 1847.1, 1868.1; *Germar, E. F.* Add. 1844.1.—*Silesia (Prov.).* *Volpersdorf.* Roemer, C. F. 1865.1.—*Westphalia (Prov.).* *Bochum.* Jaekel, O. Add. 1890.2.

Russia: *Kolomna.* Missuna, A. 1907.1.—*Mjatschkowa.* Trautschold, H. 1874.2, 1876.1.—*Moscow (Govt.).* *Niatchkovo.* Bogoliubov, N. N. Add. 1914.2.—*Tula (Govt.).* Romanovskii, G. D. 1864.1, 1866.1.—*Volga gorge.* Shtukenbergh, A. A. 1905.1.

Oceanica

Australia: *Gascoyne.* Woodward, H. 1886.1.—*New South Wales.* Egerton, P. 1864.1; Woodward, A. S. 1908.1; Koninck, L. G. Add. 1876.1, 1898.1.—*Victoria.* Chapman, F. R. 1912.1; Woodward, A. S. 1902.4, 1903.5, 1906.1.

PERMIAN

Africa

General. Hennig, E. 1913.2.—*Cape Colony, Calvinia (Dist.).* Broom, R. 1913.1.—*Madagascar.* Woodward, A. S. 1910.4.

North America

United States: *Catalogues.* Cope, E. D. 1881.1, 1890.3; *General treatise.* ★Husakof, L. 1911.2.—*Illinois.* Case, E. C. 1900.1, 1908.1, 1911.1; Cope, E. D. 1875.4, 1877.2, 8, 1884.5, 7.—*Kansas.* Eastman, C. R. 1902.9; Martin, H. T. 1913.1; Williston, S. W. 1897.1.—*Missouri.* Eastman, C. R. 1902.9.—*Nebraska.* Cope, E. D. 1891.3; Eastman, C. R. 1902.9; Knight, W. C. 1899.1.—*New Mexico.* Williston, S., & Case, E. 1912.1.—*Texas.* Cope, E. D. 1880.3, 1883.2, 1884.5, 7, 1891.3, 1895.1; Neumayer, L. 1904.2.

Palæontology — Cont'd.**Asia**

India: *Kashmir, Khunmu.* Woodward, A. S. 1905.2.

Europe

Austria-Hungary: *Bohemia, "Gaskohle."* ★Fritsch, A. J. 1874.2, 1875.1, 1877.3, 1895.1, 1897.1, (*Gen. treat.*) 1883.1; *Reviews of this work.* Cope, E. D. 1893.1; Traquair, R. H. 1893.7; Woodward, A. S. Add. 1889.3; *Braunau, Hohenelbe, Winterberg, etc.* Geinitz, H. B. 1860.1; Murchison, R. I. 1863.1; Stur, D. 1873.1; Troschel, F. H. 1851.2.

British Is.: **England, Durham (Co.),** "Marl slate."—*Catalogue.* Howse, R. 1850.1; *Monograph.* King, W. 1850.1; *List.* Etheridge, R. Add. 1888.1; *Various papers.* Brown, J. C. 1905.1; Hancock, A. 1848.1; Hancock, A., & Howse, R. 1870.1, .2; Howse, R. 1869.1, 1880.1; Kirkby J. W. 1862.1, 1863.1, 1867.1; Sedgwick, A. 1826.1, Add. 1835.1; Traquair, R. H. 1895.1.—*Warwick (Co.), Hamstead.* Hardaker, W. H. 1913.1.

France: *General.* Sauvage, H. E. 1893.2.—*Allier (Dept.), "Terrain houiller de Commeny."* Brongniart, C. 1888.1, .2; Fayol, H. 1888.1; Sauvage, H. E. 1888.3, 1889.1, 1892.1; Massal, E. Add. 1894.1.—*Hérault (Dept.), Lodève.* Sauvage, H. E. 1875.3.—*Saône-et-Loire (Dept.), Autun.* Gaudry, J. A. 1888.1, Add. 1867.1; Roche, A. 1900.1; Sauvage, H. E. 1891.5, 1893.4.

Germany: Beyrich, H. E. 1848.1; Fischer, C. E. 1856.1.—*Hesse (Grand D.), Riechelsdorf.* Münster, G. 1841.3, Add. 1842.2; Germar, E. F. Add. 1842.1.—*Prussia: Rhine Province, Lebach near Saarbrücken.* Bronn, H. G. 1829.1; Kner, R. 1868.1; Troschel, F. H. 1857.1; Weiss, E. 1864.1; Goldenberg, C. F. Add. 1873.1; Goldfuss, A. Add. 1847.1; Jordan, A. Add. 1849.1.—*Saxony (Prov.), Mansfeld.* Germar, E. F. 1824.1, Add. 1825.1; Giebel, C. G. 1856.1, 1857.1; Kurtze, G. A. Add. 1839.1; *Eisleben.* Münster, G. Add. 1842.2.—*Silesia (Prov.), Klein-Neudorf.* Roemer, C. F. 1855.1, 1857.1.—*Saxe-Coburg-Gotha, Friedrichroda.* Pohlig, H. 1892.1.—*Saxe-Weimar, Gera near Neustadt.* Geinitz, H. B. 1860.1; *Ilmenau.* Fritsch, K. Add. 1860.1.—*Saxony (Kingdom), Weissig near Pillnitz.* Geinitz, E. Add. 1875.1.

Russia: *Perm (Govt.).* Krotov, B. 1904.1; Meyer, C. E. 1860.1; *Krasnoyarsk.* Frederichs, G. Add. 1911.1.

Oceanica

Australia: *New South Wales.* Woodward, A. S. 1908.1.

MESOZOIC (ERA)**TRIASSIC****Africa**

General: Hennig, E. 1913.2.—*Belgian Congo, Lualaba.* Leriche, M. 1910.5,

1911.2.—*Orange Free State, Karroo beds.* Broom, R. 1905.1–1909.2; Woodward, A. S. 1888.14, 1889.7, 1893.3.

North America

Canada: *Alberta, Banff.* Lambe, L. M. 1913.2, 1914.1, 1916.1.—*British Columbia.* Whiteaves, J. F. 1889.1.

United States: *California.* Bryant, H. C. 1914.1; Jordan, D. S. 1907.3; Wemple, E. M. 1906.1.—*Connecticut.* Eaton, G. F. 1903.1; ★Eastman, C. R. 1911.5 (*General treatise*); Hobbs, W. H. 1901.1; Loper, S. W. 1893.1; Lull, R. S. 1912.1–1915.1; Mather, W. W. 1834.1; ★Newberry, J. S. 1878.1, 1888.1 (*Monograph*), Add. 1886.1; Redfield, J. H. 1837.1; Redfield, W. C. 1839.1, 1841.1, 1856.1.—*Idaho.* Evans, H. McL. 1904.1; Goddard, M. 1907.1.—*Massachusetts.* Brongniart, A. 1821.1; Silliman, B. 1821.1; Redfield, J. H. 1837.1; Emerson, B. K. Add. 1898.1.—*New Jersey.* Eastman, C. R. 1905.2, .6; Gratacap, L. P. 1886.1; ★Newberry, J. S. 1878.1, 1888.1 (*Monograph*); Redfield, W. C. 1839.1–1856.1; Smith, J. H. 1900.1; Hawkins, A. C. Add. 1914.1.—*North Carolina.* Emmons, E. Add. 1857.1; Leidy, J. Add. 1876.1.—*Virginia.* Redfield, W. C. 1838.1, 1853.1; Shaler, N., & Woodworth, J. 1899.1.

Asia

India: *Maledi.* Miall, L. C. 1878.3; Oldham, T. 1859.1.

Siberia: *Kubekowa.* Rohon, J. V. 1889.2; Woodward, A. S. 1889.15.

Europe

Austria-Hungary: *Bakonyerwald.* Jaekel, O. 1912.1.—*Carinthia (Prov.), Raibl.* Bronn, H. G. 1858.1; Gortani, M. 1907.1; Heckel, J. J. 1847.1, 1850.1, 1855.1; Kner, R. 1866.2, 1867.1.—*Lower Austria, Polzberg near Lunz.* Teller, F. J. 1891.1.—*Salzburg (Prov.).* Fugger, F. 1906.1; Gorjanovic-K., D. 1905.1.—*Thuringia.* Beyrich, H. E. 1850.1.—*Tyrol (Prov.), Seefeld.* Heckel, J. J. 1850.2; Kner, R. 1866.4; Murchison, R. I. 1826.1; *St. Cassian beds.* Münster, G. Add. 1841.1.—*Hungary, Vespem.* Jaekel, O. Add. 1901.1.

British Is.: *Misc. and Gen.* Ibbetson, G. A. 1867.1; Lomas, J. 1904.1; Newton, E. T. 1905.1; Wickes, W. H. 1904.1.

England: (*Chiefly Keuper*).—*Gloucester (Co.), Rhætics of Aust Cliff of Westbury-on-Severn near Bristol.* Browne, A. M. 1893.1; Davis, J. W. 1881.1; Egerton, P. 1841.2, 1854.1; Richardson, L. 1906.1; Short, A. R. 1904.1; Woodward, A. S. 1889.11.—*Leicester (Co.).* Horwood, A. R. 1907.1, Add. 1913.1; Plant, James. 1856.1; *Spinney hills, (Rhætic).* Woodward, A. S. 1889.8.—*Nottingham (Co.).* Newton, E. T. 1887.1.—*Swinerton, H. H.* 1910.1; *Colwick Wood.* Wilson, E. 1887.1.—*Warwick (Co.).* Brodie, P. B. 1856.1–

1893.1; Add. 1893.1; Newton, E. T. 1887.1; Wills, L., & Smith, W. 1913.1; Woodward, A. S. 1893.9.—*Worcester (Co.)*. Wills, L., & Smith, W. 1913.1; *Bromsgrove*. Woodward, A. S. 1910.3. **Ireland**: *Tyrone, New Red Sandstone*. Murchison, R. I. 1838.1. **Wales**: (*Rhætic*). Reynolds, S., & Vaughan, A. 1904.1.

France: *Meurthe and Vosges (Depts.)*. Mougeot, A. 1837.1.

Germany: *General*. Philippi, E., Jaekel, O. Volz, W. & Frech, F. 1903.1.—*Alsace, Wasselnheim*. Deecke, J. E. 1889.1.—*Lorraine, Falkenberg and Steinbiedersdorf*. Jaekel, O. 1889.1; *Pontpierre*. Sauvage, H. E. 1883.4.—*Anhalt (Duchy), Stassfurt*. Fritsch, K. W. 1901.1; *Bernburg*. Giebel, C. G. 1853.1.—*Bavaria*. Münster, G. *Bayreuth*, 1830.1, 1831.1, *Kelheim*, 1834.2; *Würzburg*. Sandberger, C. L. 1877.1, 1879.1; Winkler, T. C. 1880.1.—*Brunswick (Duchy), Warberg-am-Elm*. Struckmann, K. E. 1861.1, 1871.1. **Prussia**, *Brandenburg (Prov.), Rüdersdorf*. Eck, H. Add. 1872.1.—*Hannover (Prov.)*. Stolley, E. 1906.1–1913.1; *Wehmingen*. Dames, W. B. 1888.2; *Lüneburg*. Linstow, O. 1904.1; *Hildesheim*. Martin, Carl, 1874.1.—*Saxony (Prov.), Schlotheim*. Chop, K. 1857.1; *Halberstadt*. Jaekel, O. 1913.2.—*Silesia (Prov.)*. Ahlburg, J. 1906.1; Kunisch, H. 1885.1; Meyer, C. E. 1847.2, 1849.1; Michael, R. 1894.1; Volz, W. T. 1896.1; Assmann, P. Add. 1913.1; Eck, H. Add. 1865.1.—*Thuringia: Saxe-Coburg-Gotha (Duchy)*. Amthor, R. 1907.1; Giebel, C. G. 1856.2; *Coburg*. Berger, H. A. 1832.1; Schauroth, K. 1851.1; Strüver, J. K. 1865.1; *Saxe-Meiningen (Duchy), Römhild*. Bornemann, J. G. 1854.1.—*Saxe-Weimar (Duchy), Jena*. Fritsch, K. W. 1901.1; Giebel, C. G. 1848.2; Meyer, C. E. 1851.1; Schmid, E. E. 1862.1; Wagner, R. 1897.1.—*Württemberg*. Fraas, O. F. 1861.2; Plieninger, W. H. 1847.1; Meyer, C., & Plieninger, W. H. Add. 1844.1.

Italy: *Como (Prov.), Perledo*. Deecke, J. E. 1889.1; Bellotti, C. Add. 1857.1; *Galletto near Laveno*. Bassani, F. Add. 1914.1.—*Genoa (Prov.), Tinetto*. Bassani, F. Add. 1914.2.—*Lombardy*. Airaghi, C. 1908.1; Alessandri, G. 1910.1; *Besano*. Bassani, F. 1886.2; *Lumezzane (Val Trompia)*. Deecke, J. E. 1889.1; Zigno, A. 1895.1; *Valle Brembano*. Tommasi, A. 1913.1; *Varenna*. Balsamo-Crivelli, G. 1839.1; Trotti, L. 1839.1.—*Salerno (Prov.) Giffoni*. Bassani, F. 1891.2, 1892.3, 1896.1, 1899.2; Costa, O. G. 1866.2, 1868.1, Add. 1853.1, 1862.1, 1864.2; Erasmo, G. 1914.1.

Spitzbergen: Woodward, A. S. 1912.2. For an extensive recent treatise (in English), see "Triassic Fishes from Spitzbergen" by ★Erik A. von Stensiö. Part I, Vienna, 1921, 307 p., 35 pls., 90 text-figs.

Switzerland: *Basel (Canton)*. Deecke, J. E. 1889.1.—*Niederschönthal near Liestal*. Huene, F. 1911.1; Strubini, K. 1902.1.—*Neueselt*. Leuthard, F. 1901.1.

Oceanica

Tasmania: Johnston, R. M., & Morton, A. Add. 1889.1, 1890.1.

JURASSIC

Africa

Madagascar: Priem, F. 1907.1.

North America

United States: *Colorado*. Marsh, O. C. 1878.1–1878.3.—*New Jersey*. Cope, E. D. 1871.17.—*South Dakota*. Eastman, C. R. 1900.3.—*Virginia*. Lyell, C. 1847.1.—*Wyoming*. Knight, W. C. 1898.1.

Asia

India: *Deccan*. Egerton, P. 1848.3(7), 1851.1, 1878.1; Egerton, P., & Miall, L. 1877.1; Sykes, W. H. 1851.1.

Siberia: *Transbaikalia, Turga shales, near Nertchinsk*. Austin, C. E. 1862.1; Eichwald, C. E. 1863.1; Müller, J. 1847.1.—*Irkutsk (Govt.), Ust-Balei*. Becker, H. 1895.1; Rohon, J. V. 1890.1.—*Altai Range, River Kenderlyk in Maikantschat-schai Mts.* Rohon, J. V. Add. 1892.1.

Europe

British Is.: England—*General: Monograph of the Cornbrash*. Blake, J. F. 1905.1. *Distribution*. Etheridge, R. 1882.1; *Synopsis, Lower Oölites*. ★Woodward, A. S. 1890.15, 1892.11, *Purbeck formation, monograph*, Add. 1918.1. **Cambridge (Co.)**. *General acc't.* Lydekker, R. 1904.1; *Christian Malford*. Egerton, P. 1844.1; *Peterborough. (Oxford Clay)*. Leeds, — 1897.1; Woodward, A. S. 1888.11, 1892.7, 1896.5. **Dorset (Co.)**. Davies, W. 1887.1. *Charmouth*. Frost, G. A. 1913.1; *Lias of Lyme Regis*. Charlesworth, E. 1839.1; Davis, J. W. 1884.1, 2, 1885.3, Add. 1885.1; Egerton, P. 1854.1, 1858.2, 1868.1, 1871.1, 1872.2, 1876.1; Morris, J. 1869.1, 1870.1; Riley, H. 1826.1; Woodward, A. S. 1888.10, 1906.3; *Portland. (Oölite)*. Woodward, A. S. 1890.7; *Swanage*. Egerton, P. M. 1854.1; Woodward, A. S. 1895.1; *Weymouth, (Oxford Clay)*. Woodward, A. S. 1892.7, 1897.4. **Gloucester (Co.)** *Haresfield Beacon*. Beacall, T. 1898.1; *Dumbleton, (Lias)*. Woodward, A. S. 1911.1. **Leicester (Co.)**. *Barrow-on-Soar* Browne, A. M. 1889.1; Egerton, P. M. 1854.1. **Northampton (Co.)**. Thompson, B. 1885.1. **Norfolk (Co.)**. Owen, R. 1866.2. **Oxford (Co.)**. Prevost, C. 1825.1; *Culham*. Owen, R. 1866.1. **Somerset (Co.)** *Ilminster*. Woodward, A. S. 1896.3. **Sussex (Co.)** *Southwater*. Woodward, A. S. 1907.3. **Wilts (Co.)** *Vale of Wardour. (Purbeck beds)*. Woodward, A. S. 1892.9, 1895.1, 2, 1916.1. **York (Co.)** *Malton*. Jackson, J. W. Add. 1911.1; *Whitby*. Woodward, A. S. 1891.7, 1895.5. **Scotland**: *Sutherland (Co.), Brora*. Woodward, A. S. 1887.5.

Denmark: *Bornholm I.* Malling, C. & Grönwall, K. A. 1909.1.

France: *South of France*. Priem, F. 1912.3.—*Ain (Dept.), Seyssel*. Noguès, A.

Palæontology — Cont'd.

F. 1863.1; *Cerin lithographic stone of Belley Arrond., Bugey.* Eastman, C. R. 1911.1; Falsan, A., & Dumortier, V. 1872.1; Gervais, F. L. P. 1871.2, 1872.1; Saporta, L. C. 1873.1; ★Thiollière, V. J. 1840.1–1872.1.—*Calvados (Dept.).* Bigot, A. 1897.1; Bigot, A., & Brasil, L. 1904.1; Brasil, L. 1901.2; Woodward, A. S. Add. 1908.1; *Caen.* Deslongchamps, J. A. 1825.1, 1866.1; Owen, R. 1869.1, 1870.1. *Villers.* Prévost, C. 1824.1, Add. 1825.1.—*Charente (Dept.), Angoulême.* Glangeaud, P. 1896.1.—*Charente Inf. (Dept.), La Rochelle.* Glangeaud, P. 1896.1.—*Cher (Dept.), Saint-Amand.* Dagincourt, E. 1880.1.—*Eure (Dept.), Gaillon.* Fortin, R. 1900.1.—*Haute-Marne (Dept.).* Cornuel, J. 1880.1, 1883.1; Pictet, F. J. Add. 1872.1.—*Indre (Dept.).* Sauvage, H. E. 1900.1.—*Lot-et-Garonne (Dept.), Fumel.* Sauvage, H. E. 1900.2, 1902.3.—*Lozère and Burgundy.* Sauvage, H. E. 1874.2.—*Meuse (Dept.), Ville-sur-Saulx.* Cornuel, J. 1880.1, 1883.1; Verdun. Leriche, M. Add. 1914.1.—*Pas-de-Calais (Dept.), Boulogne.* Hamy, E. T. 1866.1; Sauvage, H. E. 1868.1, 1896.1, 1901.1, 1902.2, 1905.1; *Synopsis.* 1867.1, 1880.8, 1905.3.—*Rhône (Dept.), Mont d'Or.* Riche, A. 1904.1.—*Seine-Inférieure (Dept.), Cap de la Hève.* Dollfus, A. Add. 1863.1; Sauvage, H. E. Add. 1893.1.—*Vienne (Dept.), Poitiers.* Glangeaud, P. 1896.1.—*Yonne (Dept.), Vassy.* Cotteau, G. H. 1865.1; Sauvage, H. E. 1875.1, 1884.5, 1891.4, 6, 1893.5, Add. 1879.1, 1894.1.

Germany: *General treatise.* Quenstedt, F. A. 1856.1. **Alsace.** Deecke, J. E. Add. 1888.1. **Bavaria (Kingdom), Lithographic limestone.** Drevermann, F. 1910.1; Münster, G. 1842.2, 1843.1, Add. 1842.1; Reis, O. M. 1888.1; Schlosser, M. 1901.1.—*Pop. acc't.* Crook, A. R. Add. 1894.1.—*Eichstädt.* Meyer, C. E. H. 1859.5, 1863.1.—*Kelheim.* Meyer, C. E. H. 1859.2; Münster, G. 1834.2, 1836.1, 1841.1; Schlosser, M. 1883.1.—*Ratisbon.* Münster, G. 1834.1, 1836.1.—*Solenhofen lithographic stone.* Eastman, C. R. 1904.10, 1911.1, 3; Vetter, B. 1881.1; Wagner, J. A. 1846.1–1863.1; Walther, J. K. 1904.2 (list); Winkler, T. C. 1862.1, 2.—(Early reference) Rumpf, G. E. Pre-Linn. 1705.1. **Prussia. (Kingdom).** *Hannover (Prov.).* Dunker, W. 1848.1, 1851.1; Fricke, K. 1875.1; Meyer, C. E. H. 1859.3; Münster, G. 1835.1, 1846.1 (*Hildesheim*); Schöndorf, F. 1913.1; Münster, G. Add. 1842.3 (*Lindnerberg*).—*Pomerania (Prov.).* Schmidt, M. 1905.1.—*Saxony (Prov.). Halle.* Schreber, J. C. 1758.1. **Württemberg.** Bassani, F. 1880.1; Bronn, H. G. 1830.1; Münster, C. 1758.1. Quenstedt, F. A. 1847.1, 1853.1, Add. 1852.1; Zieten, C. H. 1830.1.—*Heiningen.* Jaekel, O. 1896.1, 1901.1.—*Holzmaden.* Fraas, E. 1896.1, 1910.1.—*Nusplingen.* Fraas, O. F. 1854.1; Heineke, E. 1906.1; Woodward, A. S. 1898.8.—*Zell near Boll.* Agassiz, J. L. 1832.1.

Italy: *Messina (Prov.).* Seguenza, L. 1900.1.—*Potenza (Prov.), Monte Foraporta.* Greco, B. Add. 1899.1.

Portugal: Sauvage, H. E. 1897.2, 1898.2.

Russia: (*Nomenclator palæontologicus*). Trautschold, H. 1862.1.—*Moscow (Govt.).* Trautschold, H. 1877.1, 1880.2.—*Perm (Govt.), Bogoslovsk.* Fischer von Waldheim, G. 1852.1.

Spain: *Lerida (Prov.).* Sauvage, H. E. 1902.1, 1903.1; Vidal, L. M. 1915.1.

Switzerland: Maitre, L. 1909.1.—*Basel (Canton).* Buxtorf, A. 1901.1.—*Neuchâtel (Canton).* Jaccard, S. A. 1888.1; Pictet, F. J., & Jaccard, S. A. 1860.1; Schardt, H. 1901.1; Schardt, H., & Du Bois, A. 1902.1.

Oceanica

Australia: *New South Wales.*—*Hawkesbury series, Talbragar beds.* Dana, J. D. 1848.1; David, T. W. 1890.1; Woodward, A. S. 1890.2, 1895.3, 1908.1; David, T. W., & Pittman, E. F. Add. 1895.1.—*Victoria.* Chapman, F. R. 1912.1; Woodward, A. S. 1906.5.

CRETACEOUS**Africa**

General discussion. Hennig, E. 1913.2.—*Algeria, Staoueli.* Valenciennes, A. 1844.1.—*Egypt.* Priem, F. 1914.2; *Libyan desert, Oases of Dachel and Gassr Dachel.* Quaas, A. 1902.1.—*German East Africa, Lindi.* Hennig, E. Add. 1914.1.—*Kamerun (Mamfe-Schiefern).* Jaekel, O. 1909.1; Hennig, E. Add. 1913.1.—*Madagascar.* Priem, F. 1907.1.—*Natal.* Woodward, A. S. Add. 1907.1.—*Sahara, Djoua.* Haug, E. 1904.1, 1905.1.—*Tunis.* Priem, F. 1909.2; Sauvage, H. E. 1889.2.

North America

Canada: *Northwest Territories.* Osborn, H. F., & Lambe, L. M. 1902.1; Whiteaves, J. F. 1889.1; *Fort Union group of Milk river.* Cope, E. D. 1875.6; *Belly river series.* Lambe, L. M. 1902.1.

United States: *General treatise.* ★Cope, E. D. 1875.10; *Synopsis.* Morton, S. G. 1834.1–1842.1.—*Alabama.* Tuomey, M. 1858.1.—*California.* Blake, J. H. 1873.1; Jordan, D. S. 1907.3.—*Colorado.* Cope, E. D. 1874.4, 6.—*Kansas.* Baird, S. F. 1872.8; Cope, E. D. 1871.19, 20, 1872.5, 6, 11, 1873.4, 1874.6, 1877.5, 7, 1878.6, 1892.3, (List) 1872.9; Cragin, F. W. 1894.1, 1901.1; Crook, A. R. 1892.1; Hay, O. P. 1899.2; Loomis, F. B. 1900.1; McClung, C. E. 1908.2; Mudge, B. F. 1875.1; Sternberg, C. H. 1905.1–1913.1; Stewart, A. S. 1898.1–1901.1; Williston, S. W. 1894.2, 1899.1, 1900.1, 2.—*Mississippi.* Gidley, J. W. 1913.1.—*Montana, Judith river beds.* Cope, E. D. 1877.9, 1878.2, Add. 1876.1; Hatcher, J. B. 1903.1, 1905.1; Leidy, J. 1856.4, 1858.3, 1859.2, 1860.3; Sternberg, C. H. 1914.1.—*New Jersey.* Cope, E. D. 1869.1, 1870.1, 1871.20, 21; Credner, C. H. 1870.1,

★Fowler, H. W. 1911.2; Hussakof, L. 1912.1; Leidy, J. 1857.4, 1860.6; Marsh, O. C. 1870.1, 1871.1.—*Oklahoma*. Cope, E. D. 1895.1.—*South Dakota*. Cope, E. D. 1878.1, 5; Hay, O. P. 1904.1.—*Texas*. Cope, E. D. 1892.2; Gidley, J. W. 1913.1; Moodie, R. L. 1911.1; Roemer, C. F. 1849.1, 1852.1; Hill, R. T. Add. 1901.1.—*Virginia*. Cope, E. D. 1869.1.

South America

Brazil: *Bahia (State)*. Allport, S. 1860.1; Mawson, J., & Woodward, A. S. 1907.1; Woodward, A. S. 1888.8, 1902.2, 1908.3; Cope, E. D. Add. 1886.1.—*Ceará (State)*. Agassiz, J. L. 1841.1, 1844.9; Gardner, G. 1841.1, 2; Jordan, D. S., & Branner, J. C. 1908.1; Chabrilac, F. Add. 1844.1.—*Para (State)*. Cope, E. D. 1872.13.—*Parahyba do Norte (State)*, *Parabyba*. Branner, J. C. 1902.1.—*Pernambuco and Sergipe (States)*. Woodward, A. S. 1907.2; Cope, E. D. Add. 1886.1.

Patagonia: Ameghino, F. 1896.1–1906.1; Leriche, M. 1907.2; Haupt, O. Add. 1907.1.

Asia

India: *Madras, Pondicherry beds*. Egerton, P. 1845.3; Egerton, P., & Kaye, C. 1842.1

Japan: Yabe, H. 1902.1.

Persia: Priem, F. 1908.3.

Syria: *Cretaceous of Mount Lebanon*. Bassani, F. 1882.1; Costa, O. G. 1857.1; ★Davis, J. W. 1885.1 (*General treatise*); Eastman, C. R. 1904.13; Egerton, P. 1845.1; Erasmo, G. 1912.1; Gorjanovič-K., D. 1895.1; Hay, O. P. 1903.1, 3, Add. 1903.1; Heckel, J. J. 1841.1, 1843.1; Hennig, E. 1907.2; Hussakof, L. 1916.2; Pictet, F. J. 1849.1; Pictet, F. J., & Humbert, A. 1866.1–1866.2; Woodward, A. S. 1898.4, 1898.5, 1899.1.—*Relation to Westphalian Cretaceous*. Marck, W. 1889.1.—*Comparison with English Cretaceous*. Woodward, A. S. 1888.1.—*Early ref.* Maraldi, J. P. Pre-Linn. 1720.1

Europe

Austria-Hungary: *Bohemia*. Bayer, F. 1902.1, 1908.1, 1909.1; Fritsch, A. J. 1878.1, 1879.3; Fritsch, A., & Bayer, E. 1900.1–1905.1; Laube, G. C. 1885.1; Oswald, F. 1851.1; Petrascheck, W. 1905.1; ★Reuss, A. F. 1844.1 (*General treatise*); Wilschowitz, H. 1906.1; Zahálka, C. 1897.1–1906.1; Zelizko, J. V. 1899.1.—*Dalmatia (Prov.)*, *Lesina I.* Bassani, F. 1879.2, 4, 1880.4, 1882.1; Gorjanovič-K., D. 1881.1, 1886.1, 1895.1; Heckel, J. J. 1847.1, 1850.1, 1855.1.—*Görz and Gradiska (Prov.)*. Heckel, J. J. 1849.3, 1850.1, 1855.1; *Monte S. Agata*. Bassani, F. 1884.1.—*Istria (Prov.)*, *Comen*. Bassani, F. 1879.3, 1880.4, 1881.2, 1882.1; Heckel, J. J. 1847.1, 1850.1, 1855.1; Kner, R. 1863.3, 1867.2; *Pola*. Heckel, J. J. 1847.1, 1848.2, 1850.1.—*Lower Austria (Prov.)*, *Kaltenleutgeben*. Richarz, P. S. 1905.1.

Belgium: Cornet, J. 1910.1; Dollo,

L. 1892.1, 1909.2; Forir, H. 1887.1; Woodward, A. S. 1891.5.—*Namur (Prov.)*, *Lonzée*. Leriche, M. 1911.1.—*Hainaut*. Leriche, M. 1911.3; Traquair, R. H. 1911.2; Dollo, L. Add. 1893.1.

British Is.: England. ★Woodward, A. S. *Synopsis* 1888.17, *Monographs* 1902.1, Add. 1918.1.—*Misc. and Gen.* Davies, A. M. 1899.1; Dibley, G. 1911.1; Johnson, J. P. 1901.3; Jukes-Browne, A. J. 1903.1, 1904.1; Mackie, S. J. 1863.1, 1863.2.—*Affinities of the Wealden fish-fauna*. Woodward, A. S. 1896.2.—*Bedford and Cambridge (Cos.)*. Keeping, W. Add. 1883.1.—*Kent (Co.)*. Smith, J. T. 1846.1; Owen, R. Add. 1841.1, 1842.1; *Dover*. Newton, E. T. 1878.2; *Folkstone*. Blake, C. C. 1863.1; Günther, A. 1864.2; Mason, J. W. Add. 1869.1.—*Lincoln (Co.)*, *South Ferriby*. Woodward, A. S. 1912.3.—*London (Co.)*. Treacher, L., & Osborne, H. J. 1906.1; White, H. O., & Treacher, L. 1905.1.—*Norfolk (Co.)*. Brydone, R. M. 1906.1.—*Surrey (Co.)*. Young, G. W. 1905.1.—*Sussex (Co.)*. Mantell, G. A. 1822.1–1833.1; Newton, E. T. 1877.2; Woodward, A. S. 1888.12; Dixon, F. Add. 1878.1; Newton, E. T. Add. 1878.1.—*Wight, Isle of*. Ogilby, W. 1839.1. **Ireland.** Bell, R. 1905.1.

France: *Various localities*. "Nord de la France." ★Leriche, M. 1902.2, 1906.1; "Sud de la France." Priem, F. 1912.3.—*Paris Basin, (Turonian and Senonian)*. Cornuel, J. 1880.1, 1883.1; Leriche, M. 1910.6; Priem, F. 1897.3, 1898.1, 1908.1, 1911.1; Hébert, E. Add. 1854.1.—"Sa-voie." Didélot, L. 1875.1, 2; Jacob, C. 1907.1; Pictet, F. J. 1858.1.—*Ardennes (Dept.)*, *Rethel*. Pigeot, P. 1904.2.—*Charente (Dept.)*. Coquand, H. Add. 1860.1.—*Drôme (Dept.)*. Gervais, F. L. 1855.1.—*Haute-Marne (Dept.)*, *Wassy*. Cornuel, J. 1877.1.—*Hautes-Alpes (Dept.)*, *Rosans*. Lory, C. 1879.1.—*Indre-et-Loire (Dept.)*, *Limeray*. Priem, F. 1896.1.—*Manche (Dept.)*, *Villedieu*. Priem, F. 1897.3.—*Nord Dept.*. Barrois, C. 1874.2; (*Catalogue*); Gosselet, J. A. 1875.1; Leriche, M. 1902.2, 1906.1.—*Pas-de-Calais: Dept.*, (*Boulonnais*). Leriche, M. 1906.1; Parent, H. 1903.1; *Catalogue*. ★Sauvage, H. E. 1867.1.—*Sarthe (Dept.)*. Sauvage, H. E. 1870.1.—*Seine-Inférieure (Dept.)*. Coulon, L. 1903.1.—*Somme (Dept.)*. Gervais, F. L. 1848.2; Leriche, M. 1912.1; *Péronne*. Priem, F. 1896.2.—*Vaucluse (Dept.)*, *Apt*. Arnaud, E. 1865.1, 1882.1; Pictet, F. J. 1865.1.

Germany: *Bavaria (Kingdom)*, *Mühlthal*. Bittner, A. 1898.1; *Ratisbon*. Gumbel, C. W. 1866.1; *Tölz*. Imkeller, H. 1901.1.—*Prussia: Hannover (Prov.)*, *Obernkirchen*. Branco, C. W. 1887.1, Add. 1884.1.—*Silesia (Prov.)*. Geinitz, H. B. 1868.1, 1875.1; *Glatz*. Sturm, F. 1901.1.—*Westphalia (Prov.)*, *Sendenhorst*. Bassani, F. 1882.1; Kner, R. 1868.2; Marck, W. 1862.1–1894.1, Add. 1858.1, *List* 1876.2; Marck, W., & Schlüter, C. 1865.1; *Münster*. Münster, G. 1830.2.

Palæontology — Cont'd.

Italy: *General.* Bonarelli, G. 1899.1.—*Belluno (Prov.), Castellavazzo.* Bassani, F. 1885.3, 1888.1.—*Benevento (Prov.), Pietraroja.* Bassani, F. 1882.1; Costa, O. G. 1851.1, 1864.1, 1865.1, 2, 1868.1, Add. 1853.1; Erasmo, G. 1911.1, 1914.1.—*Emilia (Prov.).* Pantanelli, D. 1904.1, 1906.1.—*Lecce (Prov.).* Erasmo, G. 1911.2.—*Lombardy.* Mariani, E. 1902.1.—*Naples (Prov.), Torre d'Orlando near Castellamare.* Bassani, F., & Erasmo, G. 1912.1; Costa, O. G. Add. 1853.1, 1864.1.—*Vicenza (Prov.), Crespano.* Bassani, F. 1880.3, 1882.1; Gallio. Canavari, M. Add. 1914.1.

Netherlands: *Maestricht.* Dames, W. B. 1881.1.—*Catalogue.* Ubaghs, J. C. 1879.1.

Portugal: Choffat, P. 1900.1, 1904.1; Sauvage, H. E. 1897.2, 1898.2.

Russia: *Crimea.* Karakash, N. I. 1907.1.—*Ekaterinoslaf (Govt.).* Favre, J. W. 1904.1.—*Kursk, Orel and Voronezh (Govts.).* Kiprijanoff, V. A. 1852.1; Fischer von Waldheim, G. 1841.1.

Sweden: ★Davis, J. W. 1890.5 (*Gen. treat.*).—*Skåne.* Nilsson, S. 1856.1.—*Limhamn.* Woodward, A. S. 1903.1.

Switzerland: Baumberger, E. 1903.1; Baumberger, E., & Moulin, H. 1898.1.—*Bern (Canton).* Rollier, H. L. 1904.1.—*Glarus (Canton).* Agassiz, J. L. 1834.7; Giebel, C. G. 1847.2.—*Neuchâtel (Canton).* Agassiz, J. L. 1835.2.—*Voiron, near Geneva.* Bassani, F. 1882.1; Pictet, F. J. 1854.1, 1858.1; ★Pictet, F. J., & Loriol, P. 1859.1.

Oceanica

Australia: *New South Wales.* Chapman, F. Add. 1914.1.—*Queensland, Rolling Downs formation.* Chapman, F. R. 1909.1; Etheridge, R. 1888.1, 1890.1, 1905.1; Etheridge, R., & Woodward, A. S. 1892.1; Woodward, A. S. 1894.6.

New Zealand: Chapman, F., & Pritchard, G. 1904.1; Davis, J. W. 1889.1; Newton, E. T. 1876.1, 1877.1.—*Notes on Davis, J. W.* Hector, J. Add. 1894.1.

Seymour I.: Woodward, A. S. 1909.1.

CENOZOIC (ERA)**Tertiary. Period indeterminate**

North America: *Cuba.* Castro, M. F. 1873.1.

South America: *Brazil, São Paulo (State), Taubaté.* Ihering, H. 1899.1; Woodward, A. S. 1899.2.—*Chile.* Möricke, W. 1895.1; Philippi, R. A. 1878.1, 1887.1.

Europe: *Austria-Hungary; Bosnia, Sarajevo.* Siebenrock, F. 1900.1.—*Spitzbergen.* Hansemann, D. 1910.1.

Oceanica: *Antarctic regions; Snow Hill, and Seymour Is.* Woodward, A. S. 1909.1.—*Padang, Sumatra I., Dutch East Indies.* Geinitz, H., & Marck, W. 1876.1; Günther, A. C. 1876.1; Marck, W. 1876.1; Rüttimeyer, C. L. 1874.1.

EOCENE**Africa**

General. Stromer, E. 1914.1, Add. 1909.1.

Algeria: Priem, F. 1903.1, 1909.1; Sauvage, H. E. 1907.2; Savornin, J. 1910.1, 1915.1.

Egypt: *Tura.* Woodward, A. S. 1910.2.—*Fayûm, chiefly Qasr-el-Sagha beds north of Birket-el-Qurun. Also called Mokattam Hills near Cairo.* Andrews, C. W. 1906.1, 1907.1; Dames, W. B. 1883.1, 1888.1; Egerton, P. 1848.3 (8); Fourtau, R. 1899.1; Fraas, E. 1907.1; Meyer, C. E. H. 1847.1; Priem, F. 1897.1, 2, 4, 1899.1, 2, 1905.1, 1907.5, 1908.4, 1914.2; Stromer, E. 1903.2, 1904.3, 1905.1; Woodward, A. S. 1893.8.

Kamerun: *Balangi.* Jaekel, O. 1904.3.

Kongo: *Landana (Paleocene).* Leriche, M. 1913.1, Add. 1913.1; Lenz, O. Add. 1877.1.

Portuguese W. Africa: *Mossamedes and Loanda.* Priem, F. 1907.2; Leriche, M. Add. 1913.1.

Senegal: Chautard, J. Add. 1905.1; Leriche, M. Add. 1913.1; Meunier, S. Add. 1898.1–1906.1.

Spanish Guinea: *Rio Benito.* Eastman, C. R. 1912.2; Stromer, E. 1912.1.

Sudan: *Togoland.* Stromer, E. 1910.1; Leriche, M. Add. 1913.1.

Tunis: Priem, F. 1903.1, 1907.5, 1909.1; Stefano, G. 1915.1.

North America

Canada: *British Columbia (Amyzon beds).* Cope, E. D. 1894.1; Lambe, L. M. 1905.1, 1906.1.

United States: *Colorado, South Park.* Cope, E. D. 1874.4, 1875.5, 1884.10.—*Maryland.* Eastman, C. R. 1901.2.—*Montana.* Cope, E. D. 1886.2.—*Nebraska.* Leidy, J. 1857.2.—*Nevada.* Cope, E. D. 1879.1.—*New Jersey.* Cope, E. D. 1869.1, 1870.1; Fowler, H. W. 1911.2; Conrad, T. A. Add. 1868.1.—*New Mexico.* Cope, E. D. 1874.5, 1876.2, 1877.10, 11, 1883.1; *Catalogue*, 1875.8.—*South Carolina.* Cope, E. D. 1876.1; Gibbes, R. W. 1847.2, 1848.1, 1849.1.—*Utah.* Cockerell, T. D. 1909.1; *Manti beds.* Cope, E. D. 1880.1.—*Virginia, Richmond.* Wyman, J. 1853.1.—*Wyoming (Bridger, etc.).* Cope, E. D. 1873.3, 1881.4, 1883.1, 3, 1886.2; Eastman, C. R. 1900.5; Leidy, J. 1872.2, 1873.3; Marsh, O. C. 1871.1; *Green River shales.* Baird, S. F. 1871.19; ★Cope, E. D. 1870.5, 1871.3, 14, 1877.1, 3, 13, 1878.1, 1879.6, 1883.3, 1884.10; Eastman, C. R. 1900.2; Whitfield, R. P. 1890.1.

West Indies: *Antigua I.* Eastman, C. R. 1911.1 (II, 346); Hussakof, L. 1907.1; Byam, F. Pre-Linn. 1756.1; Pond, A. Pre-Linn. 1756.1.—*Santo Domingo I.* Moore, J. C. 1853.1.

South America

Argentina, see Miocene and Pliocene.

Brazil: *Alagóas (State)*, *Riacho Doce*. Jordan, D. S. 1910.1.

Asia

Burma: Stuart, M. 1910.1.—*Rámri I*. Lydekker, R. Add. 1880.1.

India: *General*. Lydekker, R. 1886.1, 1887.2.—*Central Provinces, Dongargaon. (Lameta beds.)* Woodward, A. S. 1908.2, Add. 1890.1.

Turkestan: *Mangishlak Pen.* Savchenko, A. S. 1912.1, 2.

Europe

Austria-Hungary: *Carpathians*. Goryanovic-K., D. 1879.1, 1882.1.—*Nógrád, Tarnócz*. Koch, A. 1903.1, 1904.2.

Belgium: *General treatises*. ★Leriche, M. 1902.1, 1906.1; Vincent, G., & Rutot, A. 1879.1.—*Lower Eocene or Paleocene, Landenian stage*. Daimeries, A. 1888.1; Rutot, A. L. 1904.1; Lohest, M. J. Add. 1888.1; *Heersian stage*. Winkler, T. C. 1869.1, 1878.3.—*Middle Eocene, Bruxellian stage*. Beneden, P. J. 1870.2, 1873.2, 1881.1; Delheid, E. 1896.1–1908.1; Dollo, L. 1889.1; Hasse, J. C. 1879.1; Hébert, E. 1874.1; Jaekel, O. 1894.1; Le Hon, H. 1862.1, Add. 1871.1; Murlon, M. 1905.1; Noetling, F. 1886.1; Storms, R. 1892.1, 1895.1, 1901.2; Vincent, G. 1875.1; Winkler, T. C. 1874.1, 1878.2; Woodward, A. S. 1891.5; Smets, G. Add. 1886.1; *Laekenian stage*. Beneden, P. J. 1872.1, 1896.1; Jaekel, O. 1894.1; Le Hon, H. 1862.1; *Ypresian stage*. Delvaux, E. 1887.1; Delvaux, E., & Ortlieb, J. 1888.1; Leriche, M. 1912.2.—*Upper Eocene, Wemmelian stage*. Storms R. 1896.1.

British Is.: England. *London Basin*. Charlesworth, E. 1839.2, 3; Coomaraswamy, A. K. 1904.1; Leriche, M. 1906.1; Morris, J. 1853.1; Priem, F. 1912.2, 1913.1.—*Essex (Co.)*, *Walton-Naze*. Johnson, J. P. 1901.2.—*Surrey (Co.)*, *Guildford*. Buckland, W. 1838.1.—*Sussex (Co.)*. Dixon, F. Add. 1878.1.—*Isle of Sheppy*. Agassiz, J. L. 1845.2, 3, 1847.2; Koenig, C. Add. 1825.1.—*Isle of Wight*. Colenutt, G. W. 1880.1.

Denmark: *Copenhagen, (Paleocene)*. Koenen, A. 1885.1.

France: *General treatise*. ★Leriche, M. 1906.1.—*Paris Basin*. Faujas de Saint-Fond, B. 1802.1, 1803.1; Gervais, F. L. P. 1874.2; Leriche, M. 1901.3, 1906.1; ★Priem, F. 1898.2, 1904.3, 1908.1, 1911.1; (*Popular accounts*). Fritel, P. H. 1904.1–1908.1; Massat, E. 1900.1; *Paris Basin, Gypsum of Montmartre*. Cuvier, G. L. 1810.1, Add. 1812.1, 1822.1; Giebel, C. G. 1869.1; Lacépède, B. G. 1807.1; Lamétherie, J. C. 1803.1; Laville, A. 1912.1; Priem, F. 1900.2, 1906.1; Lamanon, R. Add. 1782.1; "*Calcaire Grossier de Putteaux*." Gervais, F. L. 1872.2; Meunier, S. 1872.1.—*Ardennes (Dept.)*, *Rethel*.

Priem, F. 1913.2.—*Aude (Dept.)*. Leriche, M. 1908.9; Priem, F. 1902.1; Serres, P. M. 1858.1, 1860.1, Add. 1858.1.—*Gard (Dept.)*, *Baruques d'Euzet*. Fabre, G., & Depéret, C. 1900.1; *St. Just*. Sauvage, H. E. 1875.3.—*Loire-Inférieure (Dept.)*. Leriche, M. 1906.2.—*Marne (Dept.)*, *Rheims (environs)*, *Cernaysian or Conglomérat de Cernay*. Lemoine, V. 1878.1–1896.1; Cope, E. D. 1878.4 (*Comment on Lemoine.*); Leriche, M. 1900.1, 1907.4, 1908.3; Priem, F. 1901.1.—*Nord (Dept.)*, *Vertain*. Malaquin, A. G. 1900.1.

Germany: *Alsace*. Steindachner, F. 1866.13.—*Bavaria*. Stromer, E. 1904.2; Schafhäutl, K. E. Add. 1863.1; *Wernleitener near Traunstein*. Wagner, J. A. 1860.4. *Prussia, Helmstedt, Büddenstedt and Schleweke*. Geinitz, H. B. 1883.1, 2; *East Prussia, Samland*. Noetling, F. 1885.1.

Italy: *Firenze (Prov.)*, *Ponte Nuovo*. Pasquale, M. 1904.1.—*Reggio (Prov.)*, *Gerace*. Stefano, G. 1914.1.—*Rome (Prov.)*, *Castel Madama*. Portis, A. Add. 1889.1.—*Turin (Prov.)*, *Gassino*. Bassani, F. 1899.1; Sacco, F. 1886.1; 1905.1; Sismonda, E. 1846.1; Michelotti, J. Add. 1861.1; Portis, A. Add. 1889.1.—*Tuscany (Comp.)*. Canestrelli, G. 1910.1.—*Udine (Prov.)*, *Friuli*. Bassani, F. 1889.1.—*Verona (Prov.)*, *Avesa*. Bassani, F. 1895.2; Nicolis, E. 1888.1, 1890.1.—*Verona (Prov.)*. **Monte Bolca**. Agassiz, J. L. 1832.2, *Revision* 1835.5; ★Bassani, F. 1874.1–1878.1, 1881.1, 1886.1, 1898.1; Bozza, V. 1794.1; ★Eastman, C. R. 1904.2, 13, 1905.7, 1911.1; Fortis, A. 1789.1–1794.1; Fortis, A., & Testa, D. 1793.1; Gazola, G. 1794.1, 1805.1; Graydon, G. 1794.1; Heckel, J. 1850.2, 1854.1; Heckel, J. J., & Kner, R. 1861.1; ★Jaekel, O. 1894.1; Kner, R., & Steindachner, F. 1863.1; Leriche, M. 1906.1; Liroy, P. 1865.2, 3; Maffei, S. 1795.1; Massalongo, A. B. 1859.1; Molin, R. 1860.2, 1861.1; Nero, V. dal. 1911.1 (*Bibliography*); Nicolis, E. 1893.1; Renier, S. A. 1820.1; Scortegagna, F. O. 1805.1–1841.1; Szajnocha, W. 1886.1; Testa, D. 1793.1–1793.5; Tommaselli, G. 1793.1–1795.1; Valenciennes, A. 1861.1; ★Volta, G. S. 1787.1–1796.1; ★Zigno, A. 1873.1–1876.1, 1887.1, 1890.1; Faujas de Saint-Fond, B. Add. 1807.1; Pollini, C. Add. 1816.1; Zampieri, C. Add. 1762.1.—*Early references, to be found in Pre-Linn. section*. Maffei, S. 1747.1; Maraldi, J. P. 1720.1; Marsigli, L. F. 1728.1; Matthioli, P. A. 1621.1; Moro, A. L. 1740.1; Passeri, G. 1753.1; Scilla, A. 1670.1; Spada, G. G. 1737.1–1744.1; Zannichelli, G. J. 1720.1.—*Verona (Prov.)*, *Monte Postale*. Bassani, F. 1881.1, 1898.1; Heckel, J. J. 1850.2, 1854.1; Kner, R., & Steindachner, F. 1863.1; Zigno, A. 1873.1–1876.1, 1887.1, 1890.1.—*Verona (Prov.)*, *Val Sordina*. Bassani, F. 1888.3.

Portugal: *Vizo, (Arazède)*. Sauvage, H. E. 1897.1, 2.

Rumania: Athanasiu, S. 1898.1; Cosmovici, L. 1886.1, 1887.1.—*Valea Caselor*

Palæontology — Cont'd.

near Fieni, Jalomitza district. Popovici-Hatzeg, V. 1896.1, 1901.1; Priem, F. 1899.2.

Sicily: Gemmellaro, M. 1912.2.

Oceanica

Australia: Chapman, F., & Pritchard, G. 1904.1.

OLIGOCENE**North America**

Canada: Saskatchewan (Prov.), Cypress Hills. Cope, E. D. 1891.5; Lambe, L. M. 1908.1.

United States: Colorado. Cope, E. D. 1878.1.—South Dakota. Cope, E. D. 1891.2. **Panama:** Blake, C. C. 1862.1; Joukowsky, E. 1906.1. —Gatun. Toulou, F. 1908.1.

Europe

Austria-Hungary: Bohemia. Laube, G. C. 1897.1–1905.1.—Croatia. Gorjanovic-K., D. 1882.2, 1898.2.—Galicia (Prov.), Krakowiza near Imwald. Hauer, F. 1847.1; Heckel, J. J. 1850.1.—Styria (Prov.), Parschlug. Unger, E. 1851.1; Tüffer and Trifail. Gorjanovic-K., D. 1882.4, 1895.1, 1898.2; Heckel, J. J. 1850.1; Hoernes, R. 1893.1; Wurzenegg near Prassberg. Gorjanovic-K., D. 1880.1, 1882.4; Lipold, J. 1867.1; Stur, D. R. 1867.1; Rolle, F. Add. 1858.1.—Tyrol (Prov.), Häring. Meyer, C. E. H. 1863.2.

Belgium: (Argile de Boom). Delheid, E. 1898.1–1906.1.—Rupelian stage. Dollo, L., & Storms, R. 1888.1; Leriche, M. 1902.2, 1904.1, 1908.2, 1910.4; Storms, R. 1886.1, 1893.1, 1894.1, 1896.2.

British Is.: Isle of Wight. Leriche, M. 1908.6; Newton, E. T. 1889.2, 1899.1.

France: Bouches-du-Rhône (Dept.), Aix. Faujas de Saint-Fond, B. 1806.2; Sauvage, H. E. 1873.7, 1875.3.—Gironde (Dept.). Priem, F. 1914.1, 3.—Haute-Loire (Dept.), Puy-en-Velay. Sauvage, H. E. 1869.1, 1873.4.—Paris Basin. (Stampian.) Leriche, M. 1910.2; Priem, F. 1906.2.

Germany: Alsace: Froidenfontaine. Sauvage, H. E. 1870.2, Rouffach. 1875.3; Mühlhausen. Schimper, W. P. 1860.1.—Baden (Grand D.), Weinheim. Jaekel, O. 1898.4.—Bavaria. Wolff, W. 1897.1; Siegsdorf near Traunstein. Gorjanovic-K., D. 1882.3; Wagner, J. A. 1860.4; Sieblos. Winkler, T. C. 1880.3.—Brunswick (Duchy), Helmstedt. Nehring, A. 1878.1.—Hesse (Grand D.), "Mainzer Becken." Andrae, A. 1893.1, 1894.1; Jaekel, O. 1898.4; Wittich, E. 1897.1–1900.1; Ziundorf, J. 1901.1.—Mecklenburg-Schwerin (Grand-D.), Sternberg. Winkler, T. C. 1875.1.—Prussia: Hesse-Nassau (Prov.), Frankfort-a-M. Meyer, C. E. H. 1826.1, 1831.1.—Rhine (Prov.), Bonn. Troschel, F. H. 1854.1.—Saxony (Prov.), Magdeburg. Koken, R. 1884.1; Münster, G. 1846.2.—Saxony (Kingdom), Seifhennersdorf. Cotta, B. 1868.1.

Italy: Vicenza (Prov.), Ponte near Laverda. Peters, W. Add. 1877.1.

Netherlands: Limburg. Winkler, T. C. 1880.4.

Rumania: Simionescu, J. T. 1904.1–1906.2.

Russia: Ekaterinoslaf and Poltava (Govts.). Jaekel, O. Add. 1895.1.

Sardinia: Ales. Bassani, F. 1900.1, 2, 1901.2.

Spain: "Catalonia." Leriche, M. 1910.1; Vidal, L., & Depéret, C. 1906.1.

Switzerland: Bern (Canton). Kissling, E. 1896.1.—Blauen near Basel. Jenny, F. 1905.1.—Glarus (Canton). Rath, J. J. 1859.1, 2; ★Wettstein, A. 1886.1.

Oceanica

New Zealand: Chapman, F., & Pritchard, G. 1904.1.—Oamaru system. Davis, J. W. 1889.1.

MIOCENE**Africa**

Algeria: Renwick, J. 1897.1.—Oran. Sauvage, H. E. 1873.2, 1874.6.

Egypt: Alessandri, G. 1902.2; Blanckenhorn, M. 1901.1.—Chalouf. Fuchs, T. Add. 1883.1; Laurent, C. Add. 1870.1; Priem, F. Add. 1914.1.

German E. Africa: Lindi. Hennig, E. Add. 1914.1.

Madagascar: Leriche, M. 1909.1; Priem, F. 1907.1.

Portuguese E. Africa: Mozambique (Prov.), Chandane. Priem, F. 1907.2.

Sahara: Spanish Territory, Rio Oro. Joleaud, L. 1907.1.

Tunis: Kalaa-Dyerda. Stefano, G. 1915.1.

North America

United States: California. Gilbert, J. Z. 1910.1; Jordan, D. S. 1907.3; Eigenmann, C. H. Add. 1890.1; Kern (Co.). Agassiz, J. L. 1856.3; Jordan, D. S., & Beal, C. H. 1913.1; Tulare (Co.). Blake, W. P. 1866.1.—Colorado (Florissant). Cope, E. D. 1874.4; Cockerell, T. D. 1906.1, 1908.2, Add. 1913.1.—Maryland. Cope, E. D. 1867.1; Eastman, C. R. 1904.12; Lyell, C. 1845.1.—Nevada, Esmeralda (Co.). Lucas, F. A. 1900.1, 1901.1; Osino. Cope, E. D. 1872.3, 12.—New Jersey. Cope, E. D. 1869.1, 1875.7; Fowler, H. W. 1911.2.—North Carolina. Cope, E. D. 1872.8; Lyell, C. 1845.1.—South Carolina, Ashley phosphate beds. Holmes, F. S. 1849.1, 1850.1; Leidy, J. 1860.1, 1874.1, 1876.2, 3; Newberry, J. S. 1871.1.—South Dakota. Cope, E. D. 1883.5.—Virginia. Cope, E. D. 1869.1; Leidy, J. 1873.2; Lyell, C. 1845.1.

South America

Argentina: Patagonia. Ameghino, F. 1896.1–1908.1; Leriche, M. 1907.2; Priem, F. 1912.1.

Asia

Burma: *Pegu beds.* Pascoe, E. H. 1909.1; Stuart, M. 1910.1; Noetling, F. Add. 1901.1.

Persia: Priem, F. 1908.3.

Europe

Austria-Hungary: *Bohemia.* Meyer, C. E. H. 1848.2; Procházka, V. J. 1900.1, .2; Reuss, A. E., & Meyer, H. 1851.1; Schubert, R. J. 1902.1-1912.2; *Giesshübl.* Toulou, F. 1907.1.—*Croatia, Podused.* Kner, R. 1863.3; *Radoboj.* Steindachner, F. 1859.1.—*Galicia (Prov.), Lemberg.* Lomnicki, A. M. 1897.1; *Wieliczka.* Reuss, A. E. 1866.1.—*Hungary, Budapest.* Vadasz, M. E. 1906.1; *Nógrád (Comitat).* Koch, A. 1904.3.—*Istria, Fohnsdorf.* Dreger, J. 1902.1.—*Lower Austria, Vienna Basin. (Wiener Becken)* Dunker, W. 1846.1; Münster, G. 1842.1; Schaffer, F. X. 1913.1, .2; Schubert, R. J. 1902.1-1912.2; *Hernals near Vienna.* Steindachner, F. 1859.1, 1863.6, 1864.2; *Ingersdorf near Vienna.* Fuchs, T. 1871.1; *Leithakalk of Margarethen, Vienna.* Heckel, J. J. 1855.1; Heckel, J. J., & Kner, R. 1861.1; Kner, R. 1862.1.—*Styria, Gairach.* Heckel, J. J. 1851.2.

France: *Alpes-Maritimes (Dept.), Vence.* Priem, F. 1911.2.—*Aude (Dept.), Armisan near Narbonne.* Gervais, F. L. Add. 1862.1.—*Basses-Alpes (Dept.), Céreste.* Sauvage, H. E. 1880.5.—*Côtes-du-Nord (Dept.).* Leriche, M. 1907.1.—*Drôme (Dept.), Eurre.* Fontannes, C. F. 1885.1; Sauvage, H. E. 1881.1.—*Gironde (Dept.), Léognan, Saucats, etc.* Delfortrie, E. 1871.1, 1876.2, Add. 1873.1; Gervais, F. L. 1863.1; Pédróni, P. M. 1844.1; Priem, F. 1911.2, 1914.1, .3.—*Hérault (Dept.), Castries.* Leriche, M. 1907.3.—*Ille-et-Vilaine (Dept.).* Bassani, F. 1879.1; Couffon, O. 1904.2; Leriche, M. 1907.1; Rouault, M. 1858.1; Sauvage, H. E. 1875.3.—*Loire-Inférieure (Dept.).* Priem, F. 1911.2.—*Maine-et-Loire (Dept.).* Couffon, O. 1904.2, 1905.1; Leriche, M. 1907.1.—*Puy-de-Dôme (Dept.).* Sauvage, H. E. 1873.4; Giraud, J. Add. 1902.1; Lecoq, H. Add. 1867.1.—*Rhône (Dept.).* Locard, A. 1878.1.—*Vaucluse (Dept.).* Joleaud, A. 1910.1; Joleaud, L. 1905.1, .2.

Germany: *Alsace, Haguenau.* Couffon, O. 1904.1.—*Baden (Grand Duchy), Oeningen near Constance.* Agassiz, J. L. 1832.2; Münster, G. 1834.1; Winkler, T. C. 1861.1; Woodward, A. S. 1898.6.—*Prussia: Hannover (Prov.), Hassendorf in Stade.* Jordan, A. 1901.1; *Hesse-Nassau (Prov.), Wilhelmshöhe.* Philippi, R. A. 1846.1; *Lüneburg District.* Wollemann, A. 1906.1; Reiske, J. Pre-Linn. 1684.1; *Silesia (Prov.), Oppeln.* Andreae, A. 1904.1.—*Württemberg (Kingdom), Balingen.* Bassani, F. 1880.1; Probst, J. 1874.1-1886.1; Jaekel, O. Add. 1890.4; *Steinheim.* Plieninger, W. H. 1847.1; Fraas, O. Add. 1870.1; *Unter-Kirchberg near Ulm.* Meyer, C. E. H. 1848.1, 1852.1, 1858.1.

Greece: *Euboea I.* Fischer von Waldheim, G. 1838.1, 1850.1; Valenciennes, A. Add. 1861.1.

Italy: *Alessandria (Prov.), Acqui.* Alessandri, G. 1901.1, Add. 1900.1; *Rosignano.* Alessandri, G. 1897.1; Bassani, F. 1914.1.—*Ancona (Prov.), Senigallia.* Ricci, P. 1828.1; *Fabriano.* Canavari, I. Add. 1910.1.—*Aquila (Prov.).* Lupi, A. 1904.1; Nelli, B. 1900.1.—*Belluno (Prov.).* Dal, G. 1908.1.—*Bologna (Prov.).* Bortolotti, E. 1898.1; Vinassa de Regny, P. E. 1899.1, 1902.1.—*Cuneo (Prov.), Alba.* Alessandri, G. 1896.1.—*Emilia (Prov.).* Bassoli, G. G. 1906.1-1907.1; Schubert, R. J. 1906.1.—*Forlì (Prov.), Mondaino.* Bonomi, I. 1896.1.—*Lecce (Prov.), "Pietra Leccese."* Bassani, F. 1903.1, 1914.1; Botti, U. 1879.1; Add. 1868.1; Vigliarolo, G. 1891.1; Capellini, G. Add. 1878.1; Costa, O. G. Add. 1857.1, 1858.1; Guiscardi, G. Add. 1873.1.—*Reggio (Prov.).* Seguenza, L. 1901.1; *Cutro.* Bosniaski, S. 1879.2; *Capo dell' Armi.* Stefano, G. 1910.2.—*Reggio nell' Emilia (Prov.), Montegazzo.* Ferretti, A. 1879.1, .2; *Note on this work.* Bassani, F. 1881.4.—*Rome (Prov.), Castro dei Volsci.* Bassani, F. 1909.1.—*Tremiti Is.* Bassani, F. 1907.1.—*Turin (Prov.), "Colline de Turin."* Cocchi, I. 1864.1; Sismonda, E. 1846.1-1861.1; Michelotti, J. Add. 1861.1.—*Tuscan Archip., Isola Pianosa.* Chelussi, I. 1906.1; Costa, O. G. 1863.1.—*Tuscany, Gabbro.* Bosniaski, S. 1878.1-1878.3.—*Vicenza (Prov.), Chiavon.* ★Bassani, F. 1888.2, 1892.2; Heckel, J. J. 1854.1, .5; Kner, R., & Steindachner, F. 1863.1; Liroy, P. 1865.1; Liroy, P., & Rumor, S. 1901.1; Zigno, A. 1852.1; *Remarks on Bassani, F.* Gorjanovič-K., D. Add. 1889.1.

Maltese Is.: *Malta I.* Bassani, F. 1914.1; Cooke, J. H. 1896.1; Owen, R. 1865.1; Woodward, A. S. 1887.4.

Russia: *Trans-Caucasia, Apsheron Peninsula.* Kwitka, S. K. 1901.1; Bogacev, V. V. Add. 1913.1; Lednev, N. M. Add. 1914.1.

San Marino (Republic), Monte Titano. Angelis d'Ossat, G. 1896.1; Lawley, R. 1882.1; Trabucco, G. 1906.1; Nelli, B. Add. 1906.1.

Sardinia: Angelis d'Ossat, G. 1896.2; Bassani, F. 1891.1; Pasquale, M. 1905.1; Schubert, R. J. 1907.1, 1912.1; Woodward, A. S. 1891.8.

Sicily: *Girgenti (Prov.).* Gemmellaro, G. G. 1857.1; Gemmellaro, M. 1912.1; Heckel, J. J. 1853.2; Gregorio, A. Add. 1881.1; *Licata.* Sauvage, H. E. 1870.3, 1871.1, 1873.2, 1874.6, 1881.3; *Racalmuto.* Pollini, C. 1891.1.—*Palermo (Prov.).* Gemmellaro, M. Add. 1914.1.—*Syracuse (Prov.), Ragusa.* Gemmellaro, M. Add. 1914.2.

Spain: *Murcia (Prov.), Lorca.* Sauvage, H. E. 1875.3; Botella y de Hornos, F. Add. 1868.1.

Palæontology — Cont'd.

Switzerland: Baltzer, A. 1889.1; Kissling, E. 1902.1, 2; Letsch, E. 1899.1; Musy, M. 1913.1; Würtenberger, T. 1900.1, 2.

Oceanica

Australia: Chapman, F., & Pritchard, G. 1904.1.—*Victoria*. M'Coy, F. 1866.1.

New Zealand: Davis, J. W. 1888.1, 1889.1; Hector, J. Add. 1894.1.

PLIOCENE**Africa**

Egypt: *Wadi-Natrun or Natron valley*. Stromer, E. 1904.3, 1905.1, 1914.2; Stüder, T. 1899.1.

North America

United States: *California*. Jordan, D. S. 1907.3.—*Colorado*. Cope, E. D. 1874.3.—*Idaho*. Cope, E. D. 1871.12, 1872.10, 1883.4, 6.—*Illinois*. Cope, E. D. 1894.2.—*Oregon*. Cope, E. D. 1878.3, 1883.6.

South America

Argentina: *Paraná*. Alessandri, G. 1895.2; Sangiorgi, D. 1901.1; Woodward, A. S. 1900.9.

Asia

India: *Siwaliks*. Günther, A. 1881.3; Lydekker, R. 1886.1, Add. 1882.1, 1886.1; M'Clelland, J. 1844.2.—*Rangoon, Irrawaddy series*. Pilgrim, H. G. 1906.1.

Siberia: Bogacev, V. V. 1908.1.

Europe

Austria-Hungary: *Szerem*. Koch, A. 1904.4, 1906.1.

Belgium: Dewalque, G. 1864.1, 1871.1; —*Antwerp, (Crag d'Anvers)*. Beneden, P. J. 1870.2, 1876.1, 2, 1881.1; Leriche, M. 1908.8; Storms, R. 1889.1, 1901.1.

British Is.: *England*. *Crag beds of Suffolk and Norfolk*. Prestwich, J. 1871.1. —*Suffolk (Co.), Coralline crag*. Woodward, A. S. 1890.1.—*Red Crag*. Charlesworth, E. 1837.1, 1838.1; Woodward, A. S. 1894.3.

Corsica: *Aleria*. Priem, F. 1911.2.

France: *Hérault (Dept.), "Sables marins de Montpellier"*. Doncieux, L. 1905.1; Faujas de Saint-Fond, B. 1809.1; Gervais, F. L. 1855.2; Leriche, M. 1906.3, 1907.3; Priem, F. 1904.4, 1912.4; Rüttemeyer, C. L. Add. 1857.1; Rivière, Pre-Linn. 1708.1.

Italy: *Bergamo (Prov.), Pianico*. Bassani, F. 1888.4.—*Bologna (Prov.)*. Schubert, R. J. 1907.2.—*Calabria (Comp.), Calanna*. Stefano, G. 1901.1, 1912.3.—*Emilia (Prov.)*. Schubert, R. J. 1906.1; Stefano, G. 1911.1, 1912.1.—*Messina (Prov.)*. Seguenza, L. 1900.1.—*Parma and Piacenza (Provs.)*. Carraroli, A. 1897.1.—*Piacenza (Prov.), Castell Arquato*. Brunati, R. 1909.1.—*Potenza (Prov.)*. Bassani, F. 1901.1.—*Reggio (Prov.), Calabria*. Seguenza, L. 1901.1.—*Siena (Prov.), S.*

Giovanni. Barbolani di Montauto, G. Add. 1910.1.—*Tuscany*. Bassani, F. 1901.4; Sacco, F. 1886.1, 1905.1; Sismonda, E. 1861.1; *Tuscany, Pisa (Prov.), Orciano*. Stefano, G. 1910.1; *Pisa (Prov.) Volterra*. Davis, J. W. 1887.1; Delfortrie, E. 1876.1; Gervais, F. L. P. 1875.1; Lawley, R. 1875.1–1878.4; Major, C. I. 1879.1; Meneghini, G. 1864.1–1866.1; *Val d'Arno, near Florence*. Simonelli, V. 1889.1.

Netherlands: *Limburg (Prov.), Tegelen-sur-Meuse*. Newton, E. T. 1908.1; Reid, C., & Reid, E. M. 1907.1.

Oceanica

D. E. I., Java (*Pithecanthropus strata*). Hennig, E. 1911.1.

PLEISTOCENE

For fish remains in kitchen middens; in caverns and grottos and in other associations with early man, see under *Archæology*.

North America

Canada: *Ottawa river, Greens creek*. Dawson, J. W. 1890.1.

United States: *California*. Arnold, R. 1903.1.—*Florida, Peace creek*. Leidy, J. 1889.1.—*Nevada, Hazen*. Hay, O. P. 1907.1.

Asia

Japan: *Tokio*. Tokunaga, S. 1906.1.

Europe

England: Abbott, W. J. 1908.1.—*Pre-glacial Forest Bed series*. Newton, E. T. 1882.1, 1901.1, *Grays Thurrock area*. Add. 1900.1.—*Essex (Co.), Ilford*. Johnson, J. P. 1901.1.—*Norfolk (Co.), Mundesley*. Lyell, C. 1840.1, 1842.1.—*Oxford and Wanstead dist.* Hinton, M. A. 1900.1.

France: *Allier (Dept.)*. Pomel, A. Add. 1844.1, 1846.1, 1853.1.

Germany: Keilhack, F. L. Add. 1883.1.—*Saxe-Meiningen, Saalfeld*. Richter, R. 1879.1.

Italy: *Lecce (Prov.), "Terra d'Otranto"*. Bassani, F. 1905.1.

Norway: (*Glacial marl.*) Collett, R. 1877.1, 1880.2; Sars, M. 1864.1, 1867.1.

Sweden: Holst, N. O. 1906.1; Munthe, H. W. 1910.1; Sernander, R. 1902.1.

PANCREAS

For allied organs, see under *Alimentary tract, and Liver*.

For the functions of the pancreas, see *Intestinal digestion under Digestion*.

Changes in pancreas in activity and rest (salmon). Gulland, G. L. 1898.1. — *Innervation and circulation*. Pensa, A. 1905.1. — *Structure in relation to function*. Strickland, J. G. & Earle, H. G. 1909.1.

Anatomy. *Miscellaneous and general*. Alessandrini, A. 1833.1, 1836.1; Brockmann, H. 1846.1; Harting, P. 1873.4; Laguesse, G. E. 1895.1, Add. 1891.1, 2; Massari, G. 1898.1; Stannius, F. H.

1848.1; Bernard, C. Add. 1849.1, 1856.1, 1879.1; Blasius, G. Pre-Linn. 1673.1; Commelin, C. Pre-Linn. 1667.1.

Anatomy in Cyclostomata. — *Petromyzon.* Giacomini, E. 1900.3; Picqué, R. 1913.1. — *Ammocetes.* Kupffer, C. W. 1893.2. — *Cyclostomata.* Legouis, S. 1882.1. — *Bdellostoma.* Maas, O. 1896.1, *Myxine.* 1897.1.

In Dipnoi and Ganoidei. — *Protopterus.* Laguesse, G. E. 1890.1. — *Acipenser, Amia, and Lepidosteus.* Macallum, A. B. 1886.1.

In Elasmobranchii. — *Chimæra.* Costa, O. G. 1847.1. — *Galeus.* Laguesse, G. E. 1902.1.

In Teleostei. Krüger, Albert 1905.1; Woodland, W. N. 1911.3; — *Crenilabrus.* Laguesse, G. E. 1895.1. — *Amiurus.* Macallum, A. B. 1884.1.

For the most valuable treatises on the pancreas of Teleostei, see ★Legouis, S. 1870.1, 1873.1.

Pancreatic ducts, structure and development. Laguesse, G. E. 1893.1. — *Acipenser.* Lavrov, S. 1908.2. — "Weberian tubes" or pancreatic ducts. Legouis, S. 1870.1, 1873.1.

Alleged absence of pancreas in Ostracion. Plancus, J. Pre-Linn. 1741.1.

Development. *Miscellaneous and general.* Brunn, A. W. 1896.1; ★Choronshitsky, B. 1900.1; Kupffer, C. W. 1892.1; Laguesse, G. E. 1893.1.

Development in Cyclostomata. — *Ammocetes.* Brachet, A. 1897.1. — *Petromyzon.* Giacomini, E. 1902.2; Picqué, R. 1913.1.

In Dipnoi and Ganoidei. — *Ceratodus.* Neumayer, L. 1904.1, 3. — *Acipenser.* Nicolas, A. 1904.1. — *Amia.* ★Piper, H. 1902.1, 3.

Development in Elasmobranchii. ★Brachet, A. 1896.1; Laguesse, G. E. 1894.2; Mayr, J. 1897.1; Scammon, R. E. Add. 1914.1.

In Teleostei. Goepfert, E. 1893.1; Laguesse, G. E. 1889.1, 1894.1. — *Trout.* Stöhr, P. A. 1893.1; Stricker, F. 1899.1.

Histology of pancreas. *General account.* ★Oppel, A. Add. 1900.1.

Islands of Langerhans, histological structure and physiological significance. — *Histology.* ★Diamare, V. 1899.2; Osawa, G. 1913.1. Laguesse, G. E. (*Elasmobranchii*) 1902.2; Vincent, S. & Thompson, F. D. 1907.1, 2. Rennie, J. (*Teleostei*) 1903.1, 1904.1. — *Physiological significance.* Diamare, V. & Kuliabko, A. 1904.1; Rennie, J. (*Lophius*) 1905.1.

Epithelial cyst in Petromyzon. Diamare, V. 1901.1.

PARASITES OF FISHES

This section relates specifically to the organisms living as parasites on fishes. For an intimately related section dealing more specifically with pathogenic organisms and the diseases they cause, see *Pathology of fishes.*

For larger organisms destructive to fishes, such as other fishes, birds, mammals, etc., see *Noxious organisms under Pisciculture.*

For the mutualistic association of fishes with hydroids, medusæ, molluscs, etc., see *Commensalism and symbiosis.*

The subject of parasitology is so vast and the literature so extensive that it should be obvious that the present treatment is intended to be suggestive rather than exhaustive. Those interested in finding the more recent literature and the descriptions of new species of parasites are referred to the "Zoological Record."

Discovery of parasitic borings in fossil fish scales. Rose, C. B. 1855.1.

The study of parasites as a clue to the migrations of fishes. Ward, H. B. 1908.1, 1909.1.

Popular article on parasites, with bibliography. ★Ward, H. B. 1912.1.

Parasites of the fishes — *Orthogoriscus.* Elwes, E. V. 1909.1; Beneden, P. J. Add. 1856.3; Leidy, J. Add. 1890.1. — *Malopterurus.* Fritsch, G. T. 1886.3. — *Poronotus triacanthus.* Linton, E. 1906.1, 1910.1. — *Chimæra.* Olsson, P. H. 1896.1. — *Salmo salar.* McIntosh, W. C. 1864.1; Tosh, J. R. 1905.1; ★Ward, H. B. 1910.2. — *Regalecus.* Monticelli, F. S. Add. 1900.1.

Parasites of fishes in various localities. — *Madras (List).* Bell, F. J. 1884.1. — *Belgium.* Beneden, P. J. 1871.1. — *Jamaica.* Wilson, C. B. 1911.1. — *Balaton Lake.* Rätz, S. Add. 1897.1.

Parasites of British marine fishes. Nicoll, W. 1909.1, 1910.1; Scott, A. 1903.1; Scott, T. 1902.1, 1904.1, 1905.1.

Germany, including North and Baltic Seas. Piesbergen, F. 1886.1; Schultz, G. 1911.1; Voigt, M. 1903.1; Wegener, M. 1910.1; Zschokke, F. 1891.1.

Italy and Switzerland. ★Nufer, W. 1905.1; Sonsino, P. 1891.1; Stingelin, T. 1896.1; Condorelli-Francaviglia, M. Add. 1898.1, 2.

CRUSTACEAN PARASITES

Order Copepoda

(Attached to the gill filaments or the walls of the gill chamber, or to the skin or fins.)

Enumeration of known species. ★Bassett-Smith, P. W. 1899.1 — *Review of this.* Poche, F. 1902.1.

Lists of, and treatises on American forms. Rathbun, R. 1902.1 (Should be 1884); Smith, S. I. 1874.1; ★Wilson, C. B. 1902.1–1911.4, Add. 1905.1–1913.1.

In addition to these papers, ★Prof. C. B. Wilson has since published comprehensive treatises on North American parasitic copepods belonging to the various genera or families as follows: "Genus *Lernæa*," Bull. U. S. Bur. Fish., 1915–1916 (1918), vol. 35, pp. 165–198, 10 pls. "*Lernæidæ*," Proc. U. S. Nat. Museum, 1917, vol. 53, pp. 1–150, 21 pls. "*Sphyrriidæ*," Ibid, 1920, vol. 55, pp. 549–604, 10 pls. "*Dichelesthiidæ*," ibid, 1922, vol. 60, pp. 1–100, 13 pls.

Parasitic copepods of Central Europe. Hofer, B. 1904.2.

For a valuable treatise with colored plates see "The British Parasitic Copepoda," by

Parasites — Cont'd.

★Thomas & Andrew Scott, 2 vols., Ray Soc., London, 1913.

A similar treatise in Italian, also containing colored plates, is "Copepodi parassiti dei Pesci d'Italia" by A. Brian. Geneva, 1906, 189 p., 21 plates.

Various papers on parasitic copepods. Bassett-Smith, P. W. 1896.1, 1898.1, 1899.1, Add. 1895.1, 1898.1, 2; Beneden, P. J. 1851.1, 1852.1, 1855.1, 1857.2, 3, Add. 1851.1; Brian, A. 1908.1, Add. 1899.1; Brotherson, A. 1879.1; Calderwood, W. L. 1906.2; Cornalia, E. 1875.1; Giard, A. 1888.2, Add. 1889.2; Grube, A. E. 1873.1; Haempel, O. 1907.1; Hjort, J. 1895.2; Kneeland, S. 1858.1; Neresheimer, E. 1909.2; Valle, A. 1880.1; Wright, R. R. 1882.1; Candiotti, C. Add. 1910.1; Kellicott, D. S. Add. 1880.1, 1887.1, 1892.1; Leidy, J. Add. 1888.1, 3, 1890.2; Scott, T. Add. 1900.1.

Sub-order EUCOPEPODA

Ergasilidae including *Bomolochinae*. American forms. ★Wilson, C. B. 1911.2.

Chondracanthidae; various items. Delaroche, F. E. 1810.1; Rathbun, R. 1886.1; Vogt, C. C. 1877.1; Turner, W. & Wilson, S. H. Add. 1864.1.

Philichthyidae, miscellaneous. Quidor, A. 1910.1; Vogt, C. C. 1877.1.

Lernaeidae. Various papers on the genus *Lernaea*. Baird, W. 1861.1; Goeze, J. A. 1784.1; Koelreuter, J. G. Add. 1775.1; ★Scott, A. Add. 1900.2. — *Lernæenicus sprattæ*, parasitic on eye of *Clupea sprattus*. Baudouin, M. 1904.1–1908.1; Cligny, A. 1905.3; Joubin, L. 1888.1, 2; Richiardi, S. Add. 1880.1. — *Penella remoræ* of *Remora*. Murray, A. 1856.1. — *P. filosa* in *Othogoriscus*. White, J. C. 1856.1.

Lernæopodidae, various papers. Neresheimer, E. 1909.3; Vogt, C. C. 1877.1; Wilson, C. B. 1908.1, 1911.3, 4; Wright, R. R. 1882.1. — *Lernæopoda edwardsii* Wright, cause of epidemic at brook-trout hatchery in Wisconsin. Fasten, N. 1912.1, 2.

Fasten has since published in Pubs. Puget Sound Biol. Station, 1918, vol. 2, no. 36, pp. 73–76, pl. 18; and in the American Naturalist, 1921, vol. 55, pp. 449–456.

Fasten, according to Prof. C. B. Wilson, has devised the only known practicable method for the eradication of copepods and this is effective only before or during the early stages of the parasite's attachment. Frequent salt baths consisting of a 2.50 % solution of sodium chloride in which the fry may be left 3 or 4 hours will kill the parasites. Likewise a 1 or 2 % solution of potassium chlorate or a 2 % solution of magnesium sulphate is equally effective.

Sub-order BRANCHIURA

Argulidae, European forms. Léger, L. 1906.1; Perrier, L. 1909.2; Ströbel, L. 1914.1; Hamel, E. D. Add. 1870.1.

American forms. ★Wilson, C. B. 1902.1–1908.1.

Argulus, cause of epidemic among white-fish in Minnesota. Washburn, F. L. 1886.1; Wright, R. R. 1887.1.

Order Isopoda

Cymothoidae, including the sub-families *Cymothoinae* and *Cirolaninae*. Parasitic in mouth and gill cavities and more rarely on the skin or fins of fishes. Less specialized parasites than copepods and capable of freely exchanging hosts.

Various topics. — *Conilera* destroying a captured shark. Day, F. 1884.2. — Taxonomic and natural history. Herklots, J. A. 1870.1; Lütken, C. F. 1858.1.

For the "natural history of the Isopoda," see Richardson, H. in Proc. U. S. Nat. Mus., 1904, vol. 27, 1–89.

The most comprehensive systematic treatises are ★Schioedte, J. C. & Meinert, F. "De Cirolanis *Ægas* simulantibus." Commentatio brevis, Naturhist. Tidsskr., 1879, (3) XII, pp. 279–302, pls., and especially their "Symbolæ ad Monographiam Cymothoarum, Crustaceorum Isopodum Familæ." Naturhist. Tidsskr., 1879–1884, (3) XII, pp. 321–414, pls.; XIII, pp. 1–66, 281–378, pls.; XIV, pp. 221–454, pls.

For an account in English of the European marine *Cirolaninae*, see Hansen, H. J. in Journ. Linn. Soc. London, Zool., 1905, XXXIX, pp. 337–373, pls.

MOLLUSCAN PARASITES

The glochidia or larvæ of freshwater mussels (*Unionidae*) live parasitically within a cyst formed by the epidermis of the fish parasitized. Such parasitism persists from one to several months before metamorphosis occurs and the young mussel begins a free life.

Various papers on methods of implantation of the glochidium, specific hosts, etc. Conner, C. H. 1905.1; Howard, A. D. 1913.1, Add. 1914.1, 2, 3; ★Lefevre, G. & Curtis, W. C. 1910.1, Add. 1910.1; Leonhardt, E. E. 1905.22; Young, D. 1911.1; Faussek, V. A. Add. 1895.1, 1901.1; Surber, T. Add. 1914.1.

PROTOZOAN PARASITES

All references to Protozoan parasites, generally but not always pathogenic, have for the sake of convenience been placed in the section Pathology of fishes. In that section, see under Diseases caused by Sporozoan parasites; Diseases of the blood; and Diseases of the gills and skin.

WORM PARASITES

General treatises or compendia of helminthology. Hofer, B. 1904.2; ★Linstow, O. 1878.1.

An invaluable work for the specialist, with records of occurrence and detailed references to the literature of each species of trematode, cestode, and roundworm, is the "Index-Catalogue" to which detailed references are given below under these groups. This work is a continuation of and an index to ★Stiles, C. W. & Hassall, A. 1902.1.

Miscellaneous or unclassified references to "entozoa" or worm parasites. Annone, J. J. 1759.1; Barbagallo, P. & Drago, U. 1903.1; Gressner, — 1867.1; Levander, K.

M. 1901.3, 1909.1; Lunel, G. 1880.2; Nicoll, W. 1909.1, 1910.1, Add. 1907.1; Oerley, L. 1885.1, 3; Perrot, L. 1819.1; Ward, H. B. 1894.2, 3; Zschokke, F. 1903.1, Add. 1891.1, 1896.1; Acharius, E. Add. 1780.1, 2; Cobbold, T. S. Add. 1873.1, 2, 1876.1, 1880.1; Condorelli-Francaviglia, M. Add. 1898.1, 2; Furnell, M. C. Add. 1884.1; Prenant, A. Add. 1886.1.

Early references in Pre-Linn. section. Frisch, J. 1727.1–1734.2; Garsin, L. 1730.1; Geoffroy, C. 1710.1; Rongear, — 1723.1. — *Translations of Frisch, J.* Frisch, J. L. Add. 1781.1–4.

Phylum Platyhelminthes

Class Turbellaria

Sanguinicola (Family Rhynchostomidae) living in blood of carp and tench. *Rhabdocoels* with greatly reduced pharynx. First known Turbellarian, parasitic in vertebrates. Plehn, M. 1905.1, Add. 1905.1.

Class Trematoda

For a comprehensive treatise on Trematodes, with references to the literature and detailed lists of hosts, consult the article by ★M. Braun in Bronn's "Klassen und Ordnungen des Thier-Reichs," Bd. iv, Abth. 1a, 1879–1893, pp. 303–925.

The part of the bibliography of ★Stiles, C. W. & Hassall, A. 1902.1, *dealing with trematodes, is the* "Index-catalogue of medical and veterinary zoology. Subjects: Trematoda and trematode diseases." Bull. 37, Hygienic Lab., U. S. Public Health Service, Washington, 1908, 398 p.

Miscellaneous papers on Trematoda throughout the world. Ambrose, J. 1890.1; Daday, J. 1905.1, 1907.1; Delaroche, F. E. 1810.1; Goldberger, J. 1911.1; Linton, E. 1898.3, 1912.3; Marshall, W. & Gilbert, N. C. 1905.2; Parona, C. & Perugia, A. 1889.1–1892.1, Add. 1890.1–1896.1; Perugia, A. 1895.1, 1896.1; Scott, T. 1911.1; Stafford, J. 1902.1, 1904.1, 1905.1, 1907.1, Add. 1904.1; Zacharias, E. O. 1893.1; Ariola, V. Add. 1899.1; Hausmann, L. Add. 1896.1; Luehe, M. Add. 1906.1; Maclaren, N. Add. 1903.1; Sonsino, P. Add. 1890.1, 1891.1.

Order HETEROCOTYLEA

(Chiefly ectoparasites; in fishes, infesting the gills and skin.)

Microcotyle. MacCallum, G. A. 1913.2, 3; MacCallum, G. & MacCallum, W. G. 1913.1. — *Squalonchocotyle borealis*, parasitic on sleeper shark. Ward, H. B. 1910.5.

Tristomum. Bell, F. J. Add. 1891.1; Setti, E. Add. 1898.1. — *Epibdella.* Beneden, P. J. Add. 1856.2; Schoett, H. Add. 1896.1. — *Monocotyle.* Pratt, H. S. Add. 1910.1.

Gyrodactylus, the cause of much trouble to the fish culturist. Bradley, C. L. 1861.1; ★Kathariner, L. 1895.1; Leonhardt, E. E. 1905.11; Ryder, J. A. 1884.6.

Treatment of Gyrodactyliasis. Hofer, B. 1902.1, 1904.2; Usakov, B. 1907.1; Voskresenskiĭ, A. 1909.1.

Octobothrium sagittatum as a cause of pernicious anæmia. Hofer, B. 1903.2, 1904.2.

Order ASPIDOCOTYLEA

Macraspis elegans Olsson, parasitic in gall bladder of *Chimæra*. Olsson, P. H. 1896.1.

Aspidogaster ringens Linton, and *A. kemostoma* n. sp., parasitic in alimentary tract of pompano. MacCallum, G. A. & MacCallum, W. G. Add. 1913.1.

Order MALACOCOTYLEA

(Chiefly endoparasites, infesting the alimentary tract and gall bladder, although some species of *Distomum* occur in the gills.)

Amphistomum in notochord of *Protopterus*. Burckhardt, C. R. 1891.1. — *Clinostomum marginatum* in American freshwater fishes. Osborn, H. L. 1901.1, 1911.1, 1912.1. — *Cryptogonimus chyli*, in black bass. Osborn, H. L. 1903.1, 2, 1910.1.

Diplostomum or *Holostomum cuticula*, as cause of *Diplostomiasis*. Linton, E. 1898.3; Pavesi, P. 1881.1; Poppe, S. A. 1911.1; Gamble, F. W. & Drew, G. H. Add. 1911.1.

For the anatomical details of Distomum, see ★Looss, A. Add. 1894.1.

Various papers, chiefly on Distomum. Braun, M. G. 1894.2; Cobbold, T. S. 1867.1; Johnston, S. J. 1902.1; Leidy, J. 1851.1, 2, 1853.1, 1888.2; Linstow, O. F. 1907.1; Looss, A. 1901.1; Lühe, M. 1900.1; MacCallum, W. G. 1895.1, 1905.1; Macleay, W. 1877.1; Nickerson, W. S. 1900.1; Sinicyn, D. 1905.1, Add. 1906.1; Ward, H. B. 1894.1, 1901.1; Weyenbergh, H. 1875.1, 1877.2; Chavannes, A. Add. 1851.1; Schroeder, A. E. Add. 1895.1.

Class Cestodea

(Tapeworms or Cestoda)

A valuable treatise is the article by ★M. Braun in Bronn's "Klassen u. Ordnungen," Bd. iv, Abth. 1b, 1894–1900.

The part of the bibliography of ★Stiles, C. W. & Hassall, A. 1902.1, *dealing with cestodes, is the* "Index-catalogue of medical and veterinary zoology. Subjects: Cestoda and Cestodarea." Bull. 85, Hygienic Lab., U. S. Public Health Service, Washington, 1912, 476 p.

Amphiptyches urna Wagener, from *Chimæra* and *Callorhynchus*. Haswell, W. A. 1902.2; Olsson, P. H. 1896.1; Scott, T. 1911.1; Spencer, W. B. 1899.1; Wagener, G. 1852.1.

Ligula (Riemenwurm) infesting cælom and causing peritonitis or ligulosis. Fishes, chiefly cyprinids, are the intermediate hosts, the final hosts being aquatic birds. *Miscellaneous papers.* Leidy, J. 1856.5, 1873.4; Levander, K. M. 1904.1; Linton, E. 1891.5; Neveu-Lemaire, M. 1909.1; Parona, C. & Mazza, F. 1900.1; Willer, A. 1912.1; Davaine, C. J. Add. 1865.1; Donnadieu, A. L. Add. 1870.1. — *Mortality caused by Ligula.* Hofer, B. 1904.2; Rätz, S. 1893.1.

Tetracotylus percae-fluviatilis, cause of epidemic in Italian lakes. Mazzarelli, G.

Parasites — Cont'd.

F. 1906.1; Piana, G. P. 1898.1, Add. 1898.1.

Systematic treatises on various genera. — *Proteocephalus*. Benedict, H. M. 1900.1, Add. 1902.1. — *Gyrocotyle*. Watson, E. E. 1911.1. — *Ichthyotænia*. Fuhrmann, O. 1903.1; La Rue, G. R. 1911.1; Zschokke, F. 1884.1; ★Riggenbach, E. Add. 1896.1.

Various unclassified papers on cestodes: Bothriocephalus, Tetrarhynchus, and various genera. Bergman, A. M. 1903.1; Bosuat, E. 1902.1; Cobbold, T. S. 1863.1; Duvernoy, G. L. 1842.1; Harvey, M. 1876.1; Haswell, W. A. 1902.1, Add. 1904.1; Hoek, P. P. 1879.1; Iverus, J. 1905.1; Kraemer, A. 1892.1, 2; Leidy, J. 1885.1, 1871.1, Add. 1879.2; ★Linton, E. 1889.1, 1891.1, 5, 1892.2, Add. 1889.1–1914.1; Lühe, M. 1902.1, 2; Macleay, W. 1877.1; Masi, L. 1912.1; Mola, P. 1903.1; Olsson, P. Add. 1872.2; Schneider, G. 1902.1, 2, 1903.1, 2, 14, 1904.18, 1905.5, 1910.1, 1911.2, Add. 1905.1, 2; Skorikov, A. S. 1902.1, 1903.1; Ariola, V. Add. 1899.2, 1900.1; Beneden, P. J. Add. 1849.1, 1889.1; Curtis, W. C. Add. 1890.1, 1911.1; Klaptoch, B. Add. 1906.1; Maclaren, N. Add. 1903.1; Marais de Beauchamp, P. Add. 1905.1; Mégnin, J. P. Add. 1881.1; Shipley, A. E. & Hornell, J. Add. 1906.1; Southwell, T. Add. 1911.1–1913.1.

For the occurrence of Dibothriocephalus latus in man, see Parasites of alimentary tract under Diseases of man.

Phylum Nemathelminthes

(Roundworms and Threadworms)

The part of the bibliography of ★Stiles, C. W. & Hassall, A. 1902.1, *dealing with roundworms, is the "Index-catalogue of medical and veterinary zoology. Subjects: Roundworms (Nematoda, Gordiacea, and Acanthocephali) and the diseases they cause."* Bull. 114, Hygienic Lab., U. S. Public Health Service, Washington, 1920, 881 p.

Another valuable compendium is ★Linstow, O. F. 1878.1.

The following references are not comprehensive and are given for what they may be worth.

Sub-order Nematoda

Ascaris, occurring usually in the intestine. Giard, A. 1903.3; Noël de la Morinière, S. 1804.1; Wright, R. R. 1879.1; Wyman, J. Add. 1844.1, 2.

Filaria, Ichthyonema, etc., parasitic usually in tissues. Bean, T. H. 1908.1; Leidy, J. 1878.1, 1883.1, 1886.1; Yarrell, W. 1832.2; Wedl, C. 1848.1; Baird, W. Add. 1861.1; Gemmill, J. F. & Linstow, O. Add. 1902.1.

Cystidicola farionis, a nematode, parasitic in air-bladder of trout. Fischer von Waldheim, G. Add. 1797.1, 1798.1; Shipley, A. E. Add. 1908.1.

Various papers on Nematodes. Roth, W. 1909.3; Fourment, L. Add. 1884.1;

Martin, A. R. Add. 1771.1; Shipley, A. E. & Hornell, J. Add. 1906.1.

Sub-order Acanthocephala

Chiefly the genus Echinorhynchus of which the adult forms live in the alimentary canal of fishes, the larval forms occurring in crustacea or other fishes which are the intermediate hosts. Bieler, W. 1913.1; Diesing, K. M. 1854.1; Leidy, J. 1851.1, 2, 1890.1; Neveu-Lemaire, M. 1905.1, 2; Porta, A. 1904.1, 1905.1; Stephens, J. W. & Boyce, R. 1904.1; Yarrell, W. 1832.2; Desir, — Add. 1843.1; Hyatt, J. D. Add. 1896.1.

PARASITIC FISHES

For the association of fishes with Coelenterates, Echinoderms, Molluscs, etc., see under Commensalism.

Stegophilus (Pygidiidae), parasitic in gill cavities of South American siluroids. Haseman, J. D. 1911.2; Lütken, C. F. 1880.5, 1891.1; Pellegrin, J. 1912.6; Reinhardt, J. T. 1859.1, 1860.1.

Vandellia (Candiru), as a parasite. Pellegrin, J. 1909.12, 17, 1912.6; Ribeiro, A. 1911.1.

Alleged penetration of the urethra of bathers by the "Candiru." Boulenger, G. A. 1897.6; Castelnau, F. 1855.1; Jobert, C. 1898.1; Marcoy, P. 1869.1; Orton, J. 1870.1; Poeppig, E. 1835.1; Schomburgk, R. H. 1840.1; Spix, J. B. & Agassiz, L. 1829.1; Spix, J. B. & Martius, C. F. 1823.1; Lange, A. Add. 1912.1; Woodroffe, J. F. Add. 1914.1.

For a recent summary, see ★Eigenmann, C. H. in Mem. Carnegie Mus., 1918, vol. 7, pp. 261–269.

Parasitic habits of the Lamprey eels. Jürgens, W. 1911.1; Robertson, D. 1875.1; Smith, W. S. 1905.1; Surface, H. A. 1898.1, 1899.1; Anon. 612. — *Non-parasitism of the Brook-lamprey.* Gage, S. H. 1911.1.

Data on parasitism among the various Cyclostomes will probably be found under the fishes in the Systematic Part, particularly under the headings General accounts, and Natural History.

PATHOLOGY OF FISHES

With some necessary modifications, the arrangement of this section follows that used in the "Handbuch der Fischkrankheiten" of B. Hofer, cited below. The German vernacular names in this treatise are here repeated.

For an intimately related section, not clearly separable but dealing more specifically with organisms whose presence is not generally pathogenic, see the section on Parasites of fishes.

For all abnormalities in structure and development such as double monstrosities, curvature of the spine, etc., see under Teratology.

For the association of fishes with human diseases, see Diseases of man.

For the pathological effects of refuse of factories, refineries, etc., see Depletion under Fisheries.

For the destruction of fishes by natural causes, earthquakes, hurricanes, etc.; causes of winter-killing, etc., see under Mortality.

General treatises. (*Causes, treatment, etc.*)

Text in French. Girdwoyn, M. 1880.1; Drouin de Bouville, R. Add. 1909.1; Rayer, P. F. Add. 1843.1.

Text in German. ★Hofer, B. 1901.1, 1902.1, 1904.2; Roth, W. 1912.1; Stansch, K. 1911.4.

Miscellaneous references. *Unclassified items on fish diseases.* Atkins, C. G. 1902.1; Bean, T. H. 1910.11; Buniva, M. F. 1802.1; Drew, G. H. 1910.1; Emeljanenko, P. E. 1907.3; Fuhrmann, O. 1905.4; Hendschel, — 1878.1; Huxley, T. H. 1883.1; Johnstone, J. 1905.4, 1909.2, 1910.2; Körner, O. 1877.1; Lion, — 1867.1; Pleskott, E. 1878.1; Roth, W. 1910.1,2; Schiemenz, P. 1916.1; Seal, W. P. 1889.2; Szilady, Z. 1908.1; Williamson, H. C. 1911.2,3; Sticker, A. Add. 1893.1.

Researches carried on at Vienna Tierärztliche Hochschule. Fiebiger, J. 1908.1, 1909.2, 1910.1.

VARIOUS PATHOLOGICAL CONDITIONS

Degeneration or reabsorption of eggs in ovary. Barfurth, D. 1886.1,2; Bühler, A. 1902.1.

"White spot" disease of salmon, affecting skin of the head. Cause unknown, supposedly due to retention in salt water bays because of low stage of rivers in migration time. Calderwood, W. L. 1905.3.

Ovarian cyst, caused by Trypanosomes. Chiffot, Conte & Vaney 1907.1.

Fatty degeneration of heart musculature as a secondary result of infection by the trematode, Octobothrium sagittatum. Hofer, B. 1903.2, 1904.2.

Relation of acidity of water to disease. Knauthe, K. 1908.1.

Gas disease, caused by excessive content of dissolved air in the water. Gorham, F. P. 1901.1; Marsh, M. C. 1904.1, 1908.1; Marsh, M. & Gorham, F. 1905.1. — *Notice of this.* Osgood, W. H. 1904.1.

Renal mycosis in carp. Verdun, P. 1903.1.

Ulcerative disease of the eel' (rote Beulenkrankheit). Bergman, A. M. Add. 1909.1.

Implantation of selachian embryo in spleen. Gargano, C. Add. 1914.1.

Hyperostosis or thickening of bones, considered hereditary. Köstler, M. 1882.1.

A case of exostosis. Sutton, J. B. Add. 1888.1.

Calculi or concretions, including their chemical analysis. — *Unclassified.* Fourcroy, A. & Vauquelin, L. 1807.1. — *Intestinal calculus of sturgeon.* Delachanel, B. & Mermet, A. 1874.1; Harting, P. 1875.2; Oseretskovsky, N. 1782.1; Collinson, P. Pre-Linn. 1748.1. — *Kidney concretions.* Rudolphi, C. A. 1816.1.

Biliary calculi of Cynoscion. Tower, R. W. 1902.1.

Carcinoma of the thyroid (*Cancer or endemic goitre*). *Prevalent especially in Salmonidæ.* Cause unknown (*Bösartiger Kropf*).

General treatise with full bibliography.

★Gaylord, H. & Marsh, M. Add. 1914.1.

First notice of this disease. Bonnet, R. 1883.1. — *Recognition as carcinoma.* Scott, — Add. 1892.1.

Various papers, occurrence, prophylaxis, etc. Meehan, W. E. 1912.1; Plehn, M. 1902.1, 1904.1; Gaylord, H. R. Add. 1909.1, 1910.1, 1912.1; ★Gaylord, H. & Marsh, M. C. Add. 1912.1,2; Gilruth, I. A. Add. 1902.1; Jaboulay, — Add. 1908.1; ★Marine, D. & Lenhart, C. 1910.1, Add. 1910.1–1911.2; Marsh, M. C. Add. 1910.1, 1914.1; Osburn, R. C. 1911.3, Add. 1914.2; ★Pick, L. Add. 1905.1; Smith, H. M. Add. 1909.1.

Diseases of eye. (*Lernæenicus sprattæ, a parasitic copepod, when attached to the eye of the sardine causes partial or total blindness. For references see Lernæidæ below Crustacea under Parasites.*)

Exophthalmia or protusion of the eye, a symptom often of the gas disease recorded above, or due to infection. Audigé, J. 1903.1, 1904.2; Pettit, A. 1903.1; Plehn, M. 1906.3. — *Exophthalmia caused by Bacillus collogenes.* Terni, C. 1906.1–1908.2.

Cataract or other injury, caused by various encysted parasites. Bean, T. H. 1911.16; Fuhrmann, O. 1904.1; Trojan, E. Add. 1909.1.

Opacity and perforation of the cornea, caused either by water polluted by iron, or by external injury to the eye. Bullen, G. E. 1913.2; Day, F. 1882.1; Leuckart, R. 1886.1.

Diseases of nervous system caused by parasites.

Worms encysted in brain or nerves of fishes. Brown, Albert W. 1899.1; Maddox, R. L. 1867.1; Mataré, F. 1910.1.

Myxosporidia in nervous system. Schuberger, A. & Schroeder, O. Add. 1905.1. — *Lentospora encephalica of carp.* Mulsow, K. 1911.2. — *Glugea lophii in ganglia of Lophius.* Weissenberg, R. 1911.1,2,3.

"Taumelkrankheit" of Salmonidæ, caused by an infection of the internal organs, especially the brain, by parasites, probably sporozoan. Hofer, B. 1893.1; Laveran, A. & Pettit, A. 1910.1; Mulsow, K. 1911.3; Plehn, M. & Mulsow, K. Add. 1911.1.

Neoplasms; tumors, etc. *Chiefly minor notes on their microscopic structure, occurrence, etc.* Deslongchamps, J. A. 1853.3; Drew, G. H. 1912.1; Gluge, G. 1841.1; Lawrence, G. 1895.1; McIntosh, W. C. 1885.2, 1908.1; Pesce, P. A. 1907.1; Prince, E. E. & Steven, J. L. 1892.1; ★Sandeman, G. 1893.1; Siebold, C. T. 1861.2; Tait, L. 1870.1; Wilms, M. 1895.1; Anon. 120.

"Egg-cells" in skin of Macropodus. Zschiesche, A. 1910.1.

DISEASES CAUSED BY BACTERIA

Miscellaneous papers on bacterial diseases. Bean, T. H. 1907.3; Ogle, J. W. 1873.1; Richet, C. Add. 1882.1.

Pathology — Cont'd.

Typhus epidemics in Lake Geneva, Switzerland, 1867, 1868, and 1873. Forel, F. A. 1866.1, 1874.1; Forel, F. A. & Du Plessis, G. 1868.1; Pétavel, J. 1868.1.

Bacillus. *Bacillus* sp. affecting trout at Velars, Côte d'Or, France. Bataillon, E. 1894.1.

Bacillus piscicidus versicolor, cause of epidemic at Bukarest, 1902. Babes, Y. & Riegler, R. 1905.1.

Bacillus pestis Astaci, cause of scale disease or "Lepidorthosis contagiosa" of Cyprinidae (Krebspest or Schuppensträubung). Plehn, M. 1902.2.

Bacillus piscicidus agilis. (Affecting especially *Lucioperca sandra*.) Sieber, N. 1895.1, Add. 1894.1.

Ulcerative septicæmia. Cause: *Bacillus* sp. — In trout. Bataillon, E. & Dubard, — 1895.1. — In goldfish. Ceresole, J. 1900.1. — In plaice. Riddell, W. & Alexander, D. 1912.1. — Outbreak on Bay of Nigg, Scotland. Anderson, A. Y. Add. 1911.1.

Bacillus collogenes, cause of exophthalmia. Terni, C. 1906.1–1908.2.

Bacterium. Unidentified bacterium, cause of mortality in Rhone R., 1892. Possibly identical with *Bacterium vulgare*. Charrin, A. 1893.1.

Bacterium truttæ affecting brook-trout. Marsh, M. C. 1902.1, 1903.1, 1904.2, 1907.1.

Bacterium cyprinicida Plehn, occurring especially in blood and kidneys, and cause of "Purpura cyprinorum" (Rotseuche der karpfenartigen Fische). Plehn, M. 1903.1; Spieckermann, A. & Thienemann, A. 1911.1; Thienemann, A. 1911.5.

Bacterium vulgare Wyss, cause of "Xanthosis leuciscorum" of *Leuciscus rutilus* in Lake Zürich, 1897 (Gelbseuche der Rotaugen) Wyss, O. 1898.1.

Furunculosis of Salmonids. Cause: *Bacterium salmonicida* Em. & W. Drouin de Bouville, R. 1910.1; Edwards, A. M. 1863.1; ★Emmerich, R. & Weibel, E. 1894.1; Hofer, B. 1898.2, 1901.4; Muri-sier, P. 1910.2; Neresheimer, E. 1911.3; Surbeck, G. 1909.3, 1910.5, 1911.5, 6; Fabre-Domergue, P. Add. 1890.1; Plehn, M. Add. 1911.2.

Pestis rubra anguillarum, epidemic especially in Lake Comacchio, Italy. Cause: probably *Bacillus anguillarum* (Rotseuche des Aals). Canestrini, G. (Cause discovered) 1893.1; Hofer, B. 1897.1; Hofer, B. & Doflein, F. J. 1898.1; Ing-hilleri, F. 1903.1, 1904.1; Nardo, G. D. 1866.1, 2, 3; Ninni, A. P. 1868.1; Senne-bogen, E. 1902.1.

Pestis salmonis or Salmon disease. Cause: *Bacillus salmonis pestis*, discovered by Patterson in 1903, associated with *Saprolegnia* which had been previously considered the primary cause.

Papers on the salmon disease, epidemic in England, Scotland, and Wales, 1877–1882. Brook, G. 1877.1, 1879.1; Brother-

son, A. 1883.1; Buckland, F. T. 1880.2; Buckland, F. T., Walpole, S. & Young, A. 1880.1; Christison, R. 1879.1; Clark, John 1883.1; Dougall, J. 1882.1; Huxley, T. H. 1882.1; ★Huxley, T. H. & Walpole, S. 1882.1; ★Murray, G. 1885.1; Robson, M. A. 1880.1; Rutherford, J. 1881.1, Add. 1880.1; Smith, W. A. 1883.3; Stirling, A. B. 1878.1, 1879.2; Vion, R. 1879.2; Walker, W. 1879.1; Walpole, S. & Huxley, T. H. 1882.1; Archer, W. E. Add. 1893.2; Edington, A. Add. 1889.2; Swan, A. P. Add. 1889.1.

Cause discovered. ★Patterson, J. H. 1903.1, in Pubs. Fishery Board for Scotland. 52 p., 10 pls.

Epidemic in Kura R., Russia. Arnold, J. N. 1901.1. — at Maastricht, Netherlands, 1912. Redeke, H. C. & Liebert, F. 1913.1.

For other papers on *Saprolegnia*, see Fungus growths below, under Diseases of the gills and skin.

Tuberculosis. Cause: *Bacillus tuberculosis piscium* B. D. & T. Bataillon, E., Dubard, — & Terre, —. 1897.1; Ledoux-Lebard, —. 1898.1; Dubard, —. Add. 1897.1.

Attempts (unsuccessful) at induction of mammalian tuberculosis in fishes by ingestion. Virulent bacilli in faeces, no pathogenic effects on fishes. Germano, E. 1900.1; Herzog, H. 1902.1; Hormann, — & Morgenroth, —. 1899.1; Nicolas, J. & Lesieur, C. 1899.1.

Review of piscine tuberculosis. ★Alexander, D. M. 1913.1. — Renal tuberculosis in carp. Hautefeuille, L. B. 1904.1.

DISEASES CAUSED BY SPOROZOA

For a valuable general and comprehensive treatise on the Sporozoa with lists of Sporozoan hosts and a bibliography, the reader should consult the article by ★E. A. Minchin in Lankester's Treatise on Zoology, part I, fasc. 2, London, 1903.

For the "Taumelkrankheit" of salmonids, probably caused by a Sporozoan, see above under Diseases of nervous system.

PHYLUM PROTOZOA**Class SPOROZOA****Sub-class TELOSPORIDIA**

Coccidiidea (Order). Parasites of epithelial cells chiefly of alimentary tract, liver, spleen, kidney, etc. Elmassian, M. 1909.1; Fiebiger, J. 1907.2; Piraud, V. 1909.2; ★Thélohan, P. 1890.1, 1892.2; Wierjeski, A. 1898.1, Add. 1898.1; Labbé, A. Add. 1893.1.

Hæmosporidia (Order). Blood parasites, chiefly in red blood-corpuscles. Their occurrence in fishes is not known to produce pathological effects.

Hæmogregarina, new species, occurrence, habitat, etc. Brumpt, E. & Lebailly, C. 1904.1; Laveran, A. 1900.1, 1906.1; Laveran, A. & Mesnil, F. 1901.1, 1902.3; Lebailly, C. 1904.1–1906.1; Wenyon, C. M. 1911.1; Henry, H. Add. 1910.1, 1913.1; Oertel, A. Add. 1895.1.

Sub-class NEOSPORIDIA

Myxosporidia (**Psorosperms** of fishes). Occurring in cavities of biliary or urinary organs or infesting connective or muscular tissues. Cause of virulent epidemics.

General treatise, with complete review of literature to 1894. ★Gurley, R. R. 1894.1.

Myxobolus chondrophagus Plehn, affecting the ear and associated parts and the cause of "staggers" or "Drehkrankheit" in the rainbow trout. Hofer, B. 1903.1, Add. 1903.1; Plehn, M. 1905.4, Add. 1904.1, 2; Vincent, E. 1910.1; Winter, F. W. 1905.1.

Myxobolus cyprini, cause of "Epithelioma papulosum" in the carp (*Pockenkrankheit des Karpfens*). A skin disease, secondarily accompanying infection of the kidneys by *M. cyprini*. Doflein, F. J. 1898.1, Add. 1898.1, 1899.1; Hilgendorf, F. M. 1889.1; Hilgendorf & Paulicki 1869.1; Hofer, B. 1896.3, Add. 1896.1; Wierzejski, A. 1887.1; Wittmack, M. C. 1875.1.

Myxobolus pfeifferi, cause of "Myxoboliasis tuberosa" or furuncles in the Barbel in France and Germany (*Beulenkrankheit der Barben*). Drouin de Bouville, R. 1909.1; Girard, C. F. 1890.1; Ludwig, H. 1888.1; Mégnin, J. P. 1885.2; Raillet, A. 1890.1, Add. 1886.1; Stazzi, P. 1906.1; ★Thélohan, P. 1894.1 (Cause discovered); Keysselitz, G. Add. 1908.1, 2; Mérieux & Carré Add. 1899.1; Stazzi, P. Add. 1906.1.

Myxosporidia — in brain and ganglia. Mulsow, K. 1911.2; Weissenberg, R. 1911.1, 2, 3; Schuberg, A. & Schroeder, O. Add. 1905.1. — in eggs of *Esox*. Weltner, W. 1892.1. — in gall bladder. Fujita, T. 1913.1; Amerinzew, S. Add. 1907.1, 1911.1. — in gills and skin. Stempell, W. 1904.1, 2; Schroeder, O. Add. 1906.1. — in eye of *Leuciscus*. Trojan, E. Add. 1909.1.

Various papers on the *Myxosporidia*; systematic studies, life-histories, occurrence, hosts, etc. Bütschli, O. 1881.1; Cépède, C. 1904.1, 1906.1, 2, 3, 1907.1; Chiffot, Conte & Vaney 1907.1; Cohn, L. 1896.1; Creplin, F. C. 1842.1; Fuhrmann, O. 1902.1; Gurley, R. R. 1893.1, Add. 1894.1; Johnstone, J. 1901.1, 1906.3; Laguesse, E. 1906.1; Léger, L. 1906.2, 3; Léger & Hesse, E. 1907.1; Leidy, J. 1875.1; Levander, K. M. 1900.1; Linton, E. 1891.3, 4; Lönnberg, A. J. 1894.5; Nemeček, A. 1911.1; Perugia, A. 1890.2; Plehn, M. 1906.1, 4; Prenant, A. 1902.1, 2; Reuss, H. 1907.1; Ryder, J. A. 1880.2; Schuberg, A. & Schröder, O. 1905.1; Surbeck, G. 1911.8, 9; ★Thélohan, P. 1890.1–1894.1, Add. 1890.1–1893.1; Woodcock, H. M. 1903.1, 2, 1906.1, Add. 1904.1, 2, 1907.1; Zschokke, F. 1898.1, Add. 1898.1, 2; ★Auerbach, M. Add. 1906.1–1912.1; Balbiani, G. Add. 1883.1; Müller, J. Add. 1841.1; Schmidt, —. Add. 1899.1; Tyzzer, E. E. Add. 1900.1.

INCERTAE SEDIS

Haplosporidia. Including the genus *Ichthyosporidium* of marine fishes, en-

cysted in pyloric caeca, heart, liver, and spleen. Caullery, M. & Mesnil, F. 1905.1; Robertson, M. 1908.1, 1909.1.

Serosporidia. *Lymphosporidium truttae* Calkins, cause of virulent epidemics in brook-trout. Calkins, G. N. 1900.1, 2.

DISEASES OF THE BLOOD

For sporozoan blood parasites see *Hæmosporidia* above under Diseases caused by Sporozoa.

Spirochaetes, flagellate protozoans, chiefly blood parasites but also including intestinal forms. Duboscq, O. & Lebailly, C. Add. 1912.1, 1913.1; Henry, H. Add. 1912.1; Neumann, R. O. Add. 1909.1.

Trypanosomes or Hæmoflagellates. (In fishes, chiefly of the genera *Trypanosoma* and *Trypanoplasma*.) Trypanosomiasis in fishes is the cause of anæmia but not generally of serious epidemics.

Review of literature to 1902. ★Laveran, A. & Mesnil, F. 1902.1.

Bibliography of trypanosomiasis, including fishes. Thimm, C. A. 1909.1, 1910.1.

Various papers describing new species of trypanosomes, mode of transmission by leeches, etc. Botelho, C. 1907.1; ★Brumpt, E. 1906.1, 2; Brumpt, E. & Lebailly, C. 1904.1; Keysselitz, —. 1904.1; Lebailly, C. 1904.1–1906.1; ★Léger, L. 1904.3, 4, 5, 1905.4; Manca, Gr. 1906.1; Minchin, E. A. 1898.1, 1909.1; ★Minchin, E. & Woodcock, H. 1910.1; Mokay, T. 1904.1; Montel, R. 1905.1; ★Neresheimer, E. 1911.2; Plehn, M. 1903.2, Add. 1903.1; Sabrazès, J. & Muratet, E. 1901.1, 1902.2, 1907.1, 1908.2, 1909.2, 3, Add. 1902.1, 1908.1; Valentin, G. G. 1841.1; Wenyon, C. M. 1911.1; Henry, H. Add. 1910.1, 1913.1; Lingard, A. Add. 1904.1; Neumann, R. O. Add. 1909.1.

DISEASES OF EGGS AND FRY

Diseases of eggs caused by chromogenic bacteria. Bonnet, R. 1883.1; Hofer, B. 1904.2, Add. 1898.4.

Fungi on fish eggs. Peter, G. A. 1884.1; Ryder, J. A. 1884.5; Berkeley, M. J. Add. 1864.1.

Hydrocæle embryonalis or yolk-sac disease of trout fry (*Dotterblasenwassersucht*). Probably due to pressure on developing eggs. Fiebiger, J. 1903.1.

Intestinal catarrh of trout fry, caused by artificial food of wrong chemical composition. Coester, O. 1903.1; Jaffé, S. 1895.1, 1902.2; Linke, —. 1903.1; Schillinger, A. 1894.1; Weeger, E. 1900.1.

DISEASES OF GILLS AND SKIN

Most groups of parasites infest the gills and skin. See especially Crustacean parasites under Parasites.

See also Worm parasites, of which those occurring in the gills and skin belong chiefly to the Order Heterocotylea of the Class Trematoda.

Unclassified items. Leidy, J. 1859.1; Link, L. 1911.1.

Pathology — Cont'd.

Fungus growths (Saprolegniacæ).
Causing Dermatomykosis (Pilzkrankheit).
Chief forms are Saprolegnia and Achyla.

Chiefly miscellaneous items on fungus growths. Bail, T. 1869.1; Berkeley, M. J. 1864.1; Clinton, G. P. 1894.1; Cozette, P. 1906.1; Dodge, C. W. 1896.1; Dop, P. 1905.1; Frazer, W. M. 1849.1, 1856.1; Goodsir, J. 1842.1; Leidy, J. 1859.3; ★Maurizio, A. 1897.1–1899.1; Surface, H. A. 1898.1, 1899.1; Vincent, E. 1910.1; Woodward, J. J. 1859.1; Bennett, J. H. Add. 1844.1; Cunningham, J. H. Add. 1899.1; Gerard, W. R. Add. 1878.1; Lockwood, S. Add. 1890.1. — *First known ref.* Arderon, W. Pre-Linn. 1750.2.

Methods of combating fungus, remedies, use of salt, etc. Holder, C. F. 1908.4; Mynster, W. A. 1880.1, 3; Rice, H. J. 1885.1; Spencer, L. B. 1910.1; Zirzow, P. 1906.1.

For the association of Saprolegnia with Bacillus salmonis pestis as cause of the British epidemic, 1877–82, see Salmon disease above under Diseases caused by Bacteria.

For fungi on fish eggs, see above under Diseases of eggs and fry.

Protozoan ectoparasites of gills and integument. *Occurring in both unless otherwise stated.*

Costia necatrix Henneguy, a flagellate parasitic on trout fry and causing Costiasis. (Described also as Bodo necator and Tetramitus nitschei.) Franke, J. 1908.2; Hofer, B. 1902.1; Neresheimer, E. 1911.1; Henneguy, L. F. Add. 1884.2; Nitsche, P. & Weltner, W. Add. 1894.1. — *For further studies see Moroff, in Arch. Protistenkunde, 1903, Bd. III, p. 84–89, pl.*

Cyclochaeta domerguei, Wallengren, an infusorian, causing Cyclochaetiasis. Wallengren, H. 1897.1.

Ichthyophthirius multifiliis Fouquet, a ciliate encysted in skin and causing Ichthyophthiriasis (Fleckenkrankheit). (Called Chroato-phagus parasiticus by Kerbet.) Fouquet, D. 1876.1; Henneguy, L. F. 1883.1; Hilgendorf, F. M. & Paulicki, A. 1869.1; Kerbet, C. 1886.1, Add. 1884.1; Milewski, A. 1914.3; Neresheimer, E. 1907.1, 1908.1; Schulze, L. 1914.2; Seal, W. P. 1892.1; ★Stiles, C. W. 1894.1, Add. 1894.1, 2; ★Buschkiel, A. L. Add. 1910.1; Paul, V. Add. 1914.1; Weltner, W. Add. 1895.1.

Ichthyophthirius cryptostomus of Leuciscus. Zacharias, E. O. 1892.2, 1893.3.

Amæba mucicola in gills of Labrus. Chatton, E. 1909.1.

Nosema anomalum, a myxosporidian encysting in skin of Gasterosteus. Stempell, W. 1904.1, 2.

Apiosoma piscicola, an infusorian in the skin. Blanchard, R. Add. 1885.1.

Henneguya acerina, a myxosporidian of the gills of Acerina. Schroeder, O. Add. 1906.1.

PECTORAL GIRDLE (INCLUDING STERNUM)

For related structures, see Pelvic Girdle, and Skeleton. See also Pectoral fins under Fins.

For the most important general treatise on the morphology of the pectoral girdle, see ★Wiedersheim, R. 1892.1.

For a general account of the method of suspension of the pectoral girdle from the skull, with an extensive review of the literature, see ★Siebenrock, F. 1901.1.

Anatomy and morphology. *Miscellaneous and general.* ★Gegenbaur, C. 1864.2 (ii), 1866.1; Geoffroy-Saint-Hilaire, E. F. 1807.3, 4, 7, 1818.2, 4; Lavocat, A. 1883.1; ★Parker, W. K. 1868.1; Gill, T. N. Add. 1903.1, 3.

Structure of the pectoral girdle in the following fossil fishes. — *Sauripterus.* Broom, R. 1913.3. — *Acanthodes.* Jaekel, O. 1899.3, 4, 1902.2; Traquair, R. H. 1894.4.

Anatomy in Dipnoi, Elasmobranchii, and Ganoidei. — *Dipnoi.* Gill, T. N. 1873.6; Sabatier, C. P. 1904.1. — *Elasmobranchii.* Mechnikov, O. 1879.1, 1880.2; Sabatier, C. P. 1898.1, 1903.1, 2, 1904.1. — *Acipenser.* Meissner, V. I. 1907.1, 2.

Pectoral girdles of many Elasmobranchs elaborately figured. Garman, S. 1913.1.

Anatomy in Teleostei. ★Belling, D. E. 1911.1; ★Derjugin, K. M. 1909.1; Goeldi, E. A. 1884.1; ★Haller, B. 1905.2; Swinnerton, H. H. 1905.2. — *Muraena.* Brattström, J. 1875.1. — *Cyprinidae.* Emery, C. & Simoni, L. 1886.1. — *Teuthis.* Johnstone, J. 1904.3. — *Hemibranchii.* ★Starks, E. C. 1902.2. — *Trigla.* Williamson, H. C. 1894.1.

Anatomy of the parts of the pectoral girdle. — *Scapula of Siluroids.* Baudelot, E. 1868.1. — *Coracoid of Cottus.* Baudelot, E. 1868.8. — *Clavicle and cleithrum.* ★Gegenbaur, C. 1895.1; Sabatier, C. P. 1897.1. — *Supracleithralia.* Haller, B. Add. 1914.1.

Development of pectoral girdle. *Development in — Teleosts.* Derjugin, K. M. 1909.1; Prince, E. E. 1886.3; Swinnerton, H. H. 1905.2. — *Syngnathus.* Buist, T. P. 1912.1. — *Exocætus.* Derjugin, K. M. 1908.1. — *Esox.* Gegenbaur, C. 1883.1; Swirski, G. 1880.1. — *Salmo.* Vogel, R. 1909.1. — *General accounts.* Wiedersheim, R. E. 1888.1, 1889.1, 1890.1.

Sternum. *General considerations of the "sternum" in fishes, and belief of its independence of the costal sternum of the Amniotes.* Geoffroy-Saint-Hilaire, E. F. 1807.5, 8; Lavocat, A. 1889.1; Sabatier, C. P. 1897.1, 1902.1.

Presence in the shark Hexanchus (Notidanus), of a pre-sternum derived from the ends of the coracoidal portions of the continuous pectoral girdle. Haswell, W. A. 1885.2; Parker, T. J. 1890.2, 1891.1; White, P. J. 1895.1, 2.

In the carp (Cyprinus) there is a pseudo-sternum, composed of connective tissue and elastic elements attached to the ends of the

ribs and joined mesially. Baehr, W. B. 1906.1.

For a recent detailed study of the phylogeny of the sternum in vertebrates including fishes, combining the coracoidal and costal views by considering the association with ribs as a secondary condition, see ★Hanson, F. B. in Amer. Journ. Anat., 1919-20, vol. 26, pp. 41-117.

PELAGIC FISHES

For a general treatise on "Oceanic ichthyology" with descriptions of the "pelagic fishes of the world," see ★Goode, G. B. & Bean, T. H. 1896.1.

Geographical distribution, relation of pelagic fishes to deep-sea forms, etc. Chun, C. 1886.1-1890.1.

Adaptations of sailfishes for pelagic life. Dollo, L. 1909.5.

Miscellaneous and general. Bourée, H. 1912.1; Giglioli, E. H. & Issel, R. 1884.1; Jouan, H. 1881.1; Moseley, H. N. 1882.1; Richard, J. 1905.1.

For papers on pelagic ova and pelagic larval stages, see under Planktonic fauna.

PELVIC GIRDLE (PELVIS)

For related structures, see Pectoral Girdle, and see under Skeleton. See also Pelvic fins under Fins.

For an outstanding general treatise on the morphology of the pelvic girdle, see ★Wiedersheim, R. 1892.1.

Development, evolution and phylogeny of the pelvic girdle. Paramore, R. H. 1910.1; Kehler, F. A. 1896.1; Wiedersheim, R. E. 1888.1, 1889.1, 1890.1.

Anatomy and morphology in Dipnoi. Baur, G. H. 1891.1; Römer, O. (Protopterus) 1889.1; Sabatier, C. P. 1904.1.

Anatomy of pelvis in Elasmobranchii. Baur, G. H. 1891.1; Garman, S. 1877.2, (figures) 1913.1; Mechnikov, O. 1879.1, 1880.2; Sabatier, C. P. 1898.1, 1903.1, 2, 1904.1.

Morphology in various fishes. — Eusthenopteron. Goodrich, E. S. 1901.1. — Scaphirhynchus. Mechnikov, O. 1880.1. — Rudiment in trout. Otto, A. W. 1826.2. — Caelacanthidae. Reis, O. M. 1892.3. — Ganoidei. Wiedersheim, R. E. 1882.1.

PHYSIOLOGY

For the physiology or functions of particular organs, reference should be made to those organs, such as Heart; Liver; Nervous system; Thymus; Thyroid; Suprarenal organs; Urogenital system; etc.

Additional topics of interest are Chemistry; Digestion; Respiration; Smell; Taste; Vision; etc.

For the maintenance of equilibrium, see Hearing and the Static Sense.

General treatises, text-books, etc. Text in English. — Agassiz, J. L., & Gould, A. A. 1848.1; Todd, R. B. 1859.1; Schäfer, E. A. Add. 1898.1. — Text in French. Bert, P. 1870.1; Chatin, J. 1880.1; Du-bois, R. 1898.1; Edwards, H. M. 1857.1.

— Text in German. Rudolphi, C. A. 1821.1; Bergmann, C., & Leuckart, C. G. Add. 1855.1; Pütter, A. Add. 1911.1; ★Winterstein, H. Add. 1911.1. — Text in Italian. Doria, G., Ferrari, S., & Lessona, M. 1861.1-1869.1.

Miscellaneous. Buniva, M. F. 1802.1; Hermann, L. 1894.1; Schneider, J. G. 1787.1; Szibenliszt, M. 1841.1; Treviranus, G. R., & Treviranus, L. C. 1816.1; Vaillant, L. L. 1900.2. — "Moulting" in fishes. Baudelot, E. 1867.2.

Exchange of pigments in ovary and muscle of salmon. Newbigin, M. I. 1900.1.

Starvation, effects. Barbère, A., & Bicci, G. 1903.1; Schütz, F. 1912.1, 1913.1.

Absorption, assimilation, and anabolism. Champy, C. 1912.1; Cohnheim, O. 1911.1; Devyver, J. 1823.1; Eggeling, H. 1907.1; Fabre-Domergue, P., & Bié-trix, E. 1898.1; Kerb, H. 1910.1; Macal-lum, A. B. 1894.1; Uexküll, J. 1894.1; Zuntz, N. 1879.1-1914.2; Gortner, R. A. Add. 1913.1.

Absorption of fats and fatty acids. Greene, C. W. 1912.1, 2, 5, 6; König, J., Thienemann, A., & Limprich, — 1912.1; Mottram, V. H. 1912.1.

Pütter's theory of nutrition: ordinary food insufficient and necessity of assimilation of free organic compounds from water. Pütter, A. 1909.1 — Comments on this. Biedermann, W. Add. 1911.1; Cronheim, W. Add. 1909.1.

Excretion and katabolism. Audigé, J. 1905.1; Eggeling, H. 1907.1; Haas, H. J. 1908.1; Schütz, F. 1912.1, 1913.1. — Urea, formation. Baglioni, S. 1905.1, 1906.1, 5; Gréhant, L. 1870.1, 1903.1; Gréhant, L., & Jolyet, F. 1891.1 (through electrical discharge of Torpedo); Harting, P. 1860.3; Krukenberg, C. F. 1888.1; Schröder, W. 1890.1; Wakeman, A. J. 1905.1. — Uric acid metabolism. Scaffidi, V. 1909.1; Sulima, A. 1914.1.

Metabolism in fishes, Cronheim, W. 1910.1, 1911.2.

Pressure, influences of increased and decreased pressure, etc. Baird, S. F. 1873.20; Bettoni, E. 1867.1; Bert, P. 1874.1; Carbonnier, P. 1873.1, 1874.3; Gorham, F. P. 1899.1; Hein, W. 1906.1, 1908.2; Moreau, F. A. 1876.2; Regnard, F. 1885.1, 1887.1. — Brook-trout passing through flume under 376 lbs. pressure. Anon. 417.

Osmotic pressure. Regulation, variability, dependence on external media, etc. Botazzi, F. 1906.1; Monti, R. 1915.1; Schmidt-Nielsen, S. 1909.1; Anon. 584; Coutance, H. A. Add. 1884.1.

Influence in development. Brown, O. H. 1905.1; Loeb, J. 1911.2, 1912.3; McClendon, J. F. 1913.1, 1914.2; Nordqvist, O. F. 1898.4; Philippon, M. 1912.1; Scott, G. G., & Denis, W. 1913.1; Stockard, C. R. 1907.4; Strodtmann, S. 1915.1.

For experimental variation of osmotic pressure by use of salt and sugar solutions, see below.

Physiology — Cont'd.

Effects of changes in density and salinity of water, accompanying passage of freshwater fishes to salt water and vice versa.

Miscellanea. Adam, G. 1898.1; Chaper, M. 1883.1; Schmidt-Nielsen, S. 1909.1; Tona, A. 1908.1; Anon. 497.

Physiological effects, chiefly effects upon the blood. Drzewina, A. 1906.1, 1908.1; Gautrelet, J. 1905.1 (*Review of Quinton*); Mosso, A. 1891.1; Quinton, R. 1904.2, 1905.2; Scott, G. G. 1910.1, 1911.1, 1913.2, .3, 1914.2; ★Sumner, F. B. 1905.2, .3, 1906.1, .2, 1907.2.

Fishes which can live in both salt and fresh-water. Mather, F. 1882.1; Valenciennes, A. 1841.1.

Causes of death of marine fishes in fresh-water and vice versa. Baird, S. F. 1871.7; Bert, P. 1866.1, 1869.1, 1871.2, 1873.1, 1883.1; Harting, P. 1867.2; Kirk, H. C. 1877.1; Sumner, F. B. 1912.1.

Marine fishes in fresh-water; adaptability, migrations, etc. Adam, G. 1898.1; Arnold, J. B. 1830.1; Baird, S. F. 1873.8; Blanchet, M. 1914.1; Davies, J. H. 1829.1; Day, F. 1880.14; Findeis, G. 1909.1; Gogorza, J. 1891.1; Hintze, A. 1887.1; Jammes, L. 1902.1; Jerdon, T. C. 1866.1; Kammerer, P. 1909.1; McCulloch, A. R. 1915.1 (*Galaxias, migrations*); MacCulloch, J. 1824.1, 1826.1; Nardo, G. D. 1865.1; Nazarov, J. 1901.1 (*Acipenser, migrations*); Ramsay, E. P. 1874.1; Robertson, P. A. 1907.1 (*Atherina rissoi reared in fresh-water*); Schmidt-Nielsen, S. 1910.1; Vaney, C., & Conte, A. 1902.1.

Fundulus in fresh-water. Murdoch, J. 1912.1; Smith, Eugene. 1912.1; Sumner, F. B. 1911.3.

Syngnathus in Ganges. Buchanan, F. 1822.1.

Sharks in fresh-water. Harting, P. 1876.6. — *in rivers of Borneo.* Beccari, O. Add. 1904.1; St. John, S. Add. 1844.1. — *Squatina.* Barty, T. 1884.1. — *Acanthias in Denmark.* Feddersen, A. F. 1880.2. — *Eulamia in Lake Nicaragua.* Gill, T. N. 1893.4; Lütken, C. F. 1880.2; Smith, H. M. 1893.5. — *Selache in Loch Broom.* Workman, W. H. 1906.1. — *Blue shark in Firth of Forth.* Evans, W. Add. 1898.1.

Rays in fresh-water. — *in Ganges.* Chaudhuri, B. L. 1912.3. — *in Ouse R.* Pascoe, F. 1863.1. — *Pristis.* Meyer, A. B. 1876.1; Wood, W. W. 1876.1. — *Trygon in Old Calabar R.* Smith, John Alex. 1863.5. — *Trygon and Tæniura in Amazon R.* Vaillant, L. L. 1880.2.

Fresh-water fishes in salt-water. Bade, E. 1906.1; Cornish, T. 1866.2; Harting, P. 1877.4; Kammerer, P. 1907.8; Neudörfer, A. 1907.1; Portier, P. 1914.1; Anon. 182.

Gasterosteus in salt-water. Bolau, C. C. 1905.2; Giard, A. 1900.1, .2; Knocker, H. H. 1868.1; Müllegger, S. 1906.1; Anon. 249.

Attempted hatching of salmon ova in salt-water. Nordqvist, O. F. 1898.4.

PHYSIOLOGICAL RESEARCHES**Chiefly laboratory experiments based on fish material**

For the artificial production of Cyclopia and other monstrosities, *see under Teratology.*

For Experimental embryology, *see under Embryology.*

For Galvanotaxis, Phototaxis, Rheotaxis, etc., *see under Behavior.*

For the effects of injection of foreign blood sera, including the toxic effects of eel-serum, *see Blood serum under Blood.*

For the effects of heat and cold, *see Temperature, effects.*

For the effects upon coloration of the extirpation of the eyes, *see under Coloration.*

For experiments involving various parts of the Nervous System, their electrical stimulation or their section, *see under Brain, Nervous System, and Spinal Cord.*

For experimental researches on the action of the heart, *see under Heart.*

For poisons used in fishing, *see Poisonous Plants under Fishing Methods.*

For a general discussion (in German) of many physiological researches on fishes, with an excellent bibliography, *see* ★Baglioni, S. Add. 1910.1.

Physiological effects of — Odor of hawthorn blossoms on various marine fishes. Parmentier, J. 1803.1. — *Dissolved gases, acidity, and alkalinity, and changes of temperature on the movements of marine fishes.* Shelford, V. E. & Powers, E. B. 1915.1.

Ambicoloration of flounder produced by reflection of light from mirror. Cunningham, J. T. 1891.3, 1893.10, 1895.1; Cunningham, J. T., & MacMunn, C. 1893.1.

Prolonged survival of detached heads of fishes through artificial circulation. Kulibko, A. 1907.1, .2, Add. 1907.1.

Acids and acid media. *Effects on development.* Loeb, J. 1898.1; Loeb, J., & Wasteneys, H. 1911.2, Add. 1912.1; Richet, C. R. 1886.1, .2; Whitley, E. 1906.1. — *Carbonic acid, effects.* Bert, P. 1875.1; Kupzis, J. 1901.1; Reuss, H. 1909.1, .2, 1910.1.

Alkaline or basic media: chiefly by use of sodium salts. — *Physiological effects.* Cololian, P. 1901.1; Cooke, E., & Loeb, L. 1909.1; Dubois, R. 1895.1; Kahlenberg, L., & Mehl, H. 1901.1, Add. 1901.1; Levy, M. 1909.1; Loeb, J. 1898.1, 1911.1, 1912.3, Add. 1912.1; Loeb, J., & Wasteneys, H. 1911.1, .3, 1912.3; Mathews, A. P. 1905.1; Pigorini, L. 1907.1 (*silver salts*); Richet, C. R. 1886.1, .2; Ringer, S. 1883.1, 1884.1; Siedlecki, M. 1903.1; White, G., & Thomas, A. 1912.1 (*copper salts*); Whitley, E. 1906.1; Hirsch, E. Add. 1914.1.

Effect upon cardiac activities. Hyde, I. H. 1908.1, 1909.1; Knight, A. P. 1897.1; Polimanti, O. 1911.1, .4.

Reactions to acidity and to alkalinity. Shelford, V. E. 1915.1; Sheldon, R. E. 1909.3; Wells, M. M. 1915.1, .2.

Drugs, alkaloids, narcotics, poisons, etc. *Physiological influences, effects upon cardiac activities, etc.* Beresin, W. I. 1913.1; Cooke, E., & Loeb, L. 1909.1

(*Staining solution*); Desor, P. J. 1848.1 (*Chloroform*); Fraenkel, A. 1903.1 (*Alkaloid of castor oil*); Kochmann, M. 1913.1; McClendon, J. F. 1912.2; Mills, T. W. 1885.1; Mitchell, S. W. 1859.1 (*Ammonia, glycerine and vacuum*); Polimanti, O. 1911.1; Rabuteau, A., & Papillon, F. 1873.2 (*Morphine, strychnine and thebaine*); Regnard, P. 1885.2 (*Chlorohydrate of cocaine*); Retzius, M. G. 1898.1; Reuss, H. 1911.2; Schmid, B. 1911.1 (*Veronal and trional*); Sheldon, R. E. 1909.3; Straub, W. 1901.1 (*Antiarin and strophantin*); Sulima, A. 1909.1; Thiergardt, A. 1897.1; Denis, W. Add. 1913.2; Sollmann, T. Add. 1906.1.

Alcohol, effects. Cololian, P. 1901.2; Flamel, O. 1897.1; Lebedintsev, A., & Nedsoivin, A. 1912.1; Linossier, G. 1901.1; Mitchell, S. W. 1859.1; Otto, G. 1912.1.

Curare, effects on nerves and electrical organs. Cavalié, M. 1904.2; Moreau, F. A. 1860.1, 2; Schoenlein, K. 1895.3; Steiner, J. Add. 1875.1.

For injurious effects of factory refuse, mine seepage, naphtha, sawdust, etc., see Pollution of streams under Fisheries.

Gases. Atmospheric gases, dissolved or in solution. — *Effect of excess of nitrogen.* Birge, E., & Juday, C. 1911.1. — *Oxygen and carbon dioxide; combinations, relation to respiration, etc.* Orsenigo, L. 1910.1; Osborne, W., & Muntz, E. 1906.1; Perrier, L., & Labatut, — 1900.1; Wells, M. M. 1913.1; Roaf, H. E. Add. 1912.1.

Reactions to gradients of dissolved gases. Shelford, V., & Allee, W. 1913.1, 1914.1.

Early experiments on keeping fishes in boiled water and in water in vacuo. Boyle, R. Pre-Linn. 1670.2; Hauksbee, F. Pre-Linn. 1712.1.

Dissolved gases in lakes as factors in distribution of fishes, see under Ecology.

Glucosides, sugar solutions, etc. *Effects, toxicity, etc.* Bataillon, E. 1901.1, 2; Hédon, E. 1901.1; Loeb, J. 1912.2; Paokard, W. H. 1907.1, Add. 1905.1.

Radium, influences. Mendelssohn, M. 1905.1; Oppermann, K. 1913.1; Tur, J. 1906.1–1913.1.

Physiology of various fishes. *General, unclassified, and unidentified references to the physiology of the fishes named.* — *Dipnoi.* Ayers, H. 1885.1. — *Amphioxus.* Bert, P. 1874.2. — *Seiachii.* Costa, O. G. 1857.3. — *Amiurus.* Lavauden, L. 1905.2. — *Ceratodus.* Margo, T. 1894.1, 2. — *Squalus.* Vrolik, G. 1826.1, 1828.1.

PISCICULTURE

For all topics relating to the practical aim or commercial utilization of fish-culture, see the section on Fisheries.

See also Diseases under Pathology; Parasites; and for care of ornamental fishes, see Aquaria, and also Aquarium Fishes.

GENERAL TREATISES

See also the general treatises cited under Pond culture, below.

Text in English. Chambers, W. O. 1883.2; Coste, J. J. 1866.1; Day, F. 1883.2; Ferguson, T. B. 1880.1; Francis, F. 1862.1, 1865.1, 1883.1; Fry, W. H. 1854.1, 1866.1; Garlick, T. 1857.1, 1880.1; Green, S. 1888.1; Klippart, J. H. 1873.1; Marston, R. B. 1883.2; Norris, T. 1868.1; Peard, W. 1861.1; Roosevelt, R. & Green, S. 1879.1, 1885.1; Walker, C. E. 1901.1; Wright, W. 1858.1; Noel, E. Add. 1841.1. — *Art. in Encyc. Britannica.* Goode, G. B. 1885.4.

See especially "A manual of fish-culture." ★Anon. 574. Revised edition, Doc. 345, 1900.

Text in French. Baude, J. J. 1861.1; Beaumont, E. H. 1869.1; Blanchon, H. 1898.1, Add. 1909.1; Brocchi, P. 1886.1, 1896.1; Carbonnier, P. 1864.1; Coste, J. J. 1853.1, 1858.1, 1869.2; Fraiche, F. 1863.1; Galbert, A. 1865.1; Gauckler, P. 1879.1, 1880.1; Gobin, A. 1889.1; Gobin, A. & Guénaux, G. 1907.1; Jaffier, J. 1897.1; Joigneaux, P. 1864.1; La Blanchère, P. 1866.1, 1877.1; Landes, C. 1890.1; Lanza, A. 1862.1; Larbalétier, A. 1886.1; Millet, C. 1870.1; Moncoq, V. 1902.1; ★Raveret-Wattel, C. 1904.1, Add. 1914.1; ★Roule, L. 1914.8; Wallon, E. 1868.1; Anon. 421; ★Guénaux, G. Add. 1910.1; ★Peupion, A. Add. 1898.1.

Text in German. Boccus, G. 1861.1; ★Borne, M. 1875.1, 1881.1, 1885.2, 1895.1, Add. 1887.1; ★Borne, M., Benecke, B. & Dallmer, E. 1886.1; Eckstein, K. 1902.1; Günderlich, A. 1861.1; Haack, H. 1872.3; Hamm, W. 1861.1; Hetting, M. G. 1871.1; Kaufmann, E. 1859.1; Lampe, — 1909.1; Meyer, J. 1877.1; Molin, R. 1864.1; Pressel, W. 1902.1; Vogt, C. C. 1859.1, 1875.1; Wirth, M. 1863.1; Wozelka, K. 1893.1.

Text in other languages. *Dutch.* Schlegel, H. 1857.1; Anon. 285. — *Finish.* Edlund, G. W. 1886.1; Holmberg, H. J. 1858.1. — *Italian.* Bardi, U. 1879.1; ★Supino, F. 1914.1; Vogt, C. C. 1865.1. — *Russian.* Grimm, O. 1902.4. — *Spanish.* ★Cházari, E. 1884.1; Graells, M. 1864.1, 1867.1. — *Swedish.* ★Limborg, H. 1880.1.

HISTORICAL MATTERS

For literature on Roman fish ponds see Marine fish-farming below under Pisciculture, Italy. See also under Pisciculture, United States, for additional historical references.

General treatises. Armistead, J. J. 1870.1; ★Goode, G. B. 1881.2.

Origin and early development of pisciculture, especially in European countries. Bout, H. 1879.1; Haacke, J. W. 1901.1; ★Haime, J. 1854.1–1874.1; Leonhardt, E. E. 1901.3; Reynoso, A. 1856.1.

First use of artificial fertilization by Jacobi in Lippe-Detmold, Westphalia, about 1741. Jacobi, S. L. 1763.1–1853.1. —

Pisciculture — Cont'd.

Translations and views of importance of Jacobi's discoveries. Duhamel du Monceau, H. L. 1773.1; Gleditsch, J. G. 1764.1; Anon. 539. See also L. Hapke, in *Abhand. Naturw. Ver. Bremen*, VI, 1876, p. 157.

Application and extension of Jacobi's methods to studies in embryology. Rusconi, M. 1835.1, 2, 3, 1840.1, 1854.1; Spallanzani, L. 1783.2, 4.

Disbelief of practice of artificial fertilization by Romans. Geoffroy-Saint-Hilaire, I. 1854.1.

Initial efforts in France. Blanchard, C. E. 1868.1, 1869.2; Millet, C. 1870.1. — *History, 1884-1900.* ★Jousset de Bellesme, G. 1909.1.

Results (announced by Haxo in 1849) of artificial fertilization as practised by Géhin & Rémy at La Bresse in Dept. of Vosges. Géhin, J. & Rémy, — 1851.1, 2; Haxo, J. 1849.1-1860.1.

Revival of interest in pisciculture through above efforts and publications of Coste, J. 1853.1; Quatrefages, J. 1848.1, 1851.1, 1854.1; Millet, C. 1854.1, 2, 3, 1855.3; Milne-Edwards, A. & Coste, J. 1850.1.

Comments and notices throughout Europe, on results of Géhin & Rémy. Block, M. 1853.1; Caron, C. 1852.1; Chabot, — 1854.1; Chavannes, A. 1854.1; Detzem, — & Berthelot, S. 1851.1; Gillet de Grandmont, A. 1862.1, 1863.4, 1864.1; Godenier, C. 1852.1, 1866.1; Günderlich, A. 1861.1; Heurtier, — 1852.1; Humbert-Claude, E. 1897.1; Huyssen van Kattendijke 1853.1; Jourdier, A. 1856.1; Koltz, J. P. 1858.1; Malischeff, P. 1856.1; Mène, C. 1851.1; Meunier, A. V. 1863.1; Morganti, G. 1854.1; Noël, E. 1856.1.

For first of public Fish-cultural establishments, started at Hüningen, Alsace, in 1850, see below under Germany.

Stocking of waters

General treatises on principles of setting out fishes. Text in French. Chauvassaignes, F. 1880.1; Léger, L. 1908.1, 1909.1. — *Text in German.* Leonhardt, E. E. 1908.3; Seligo, A. 1908.1.

Miscellaneous papers. Borne, M. 1877.4, 1878.14; Edwards, H. M. 1857.2; Green, S. 1875.1, 9; Lindes, L. 1880.2; Peirce, M. P. 1877.1.

Proper age for planting; discussions of advantages of fingerlings over fry and vice versa. Borne, M. 1872.1; Clark, F. N. 1887.1; Hartmann, W. 1870.2; Leary, J. L. 1908.1; Nevin, J. 1893.1; Page, W. F. 1894.1; S., W. G. 1880.1; Surbeck, G. 1910.2; Whitaker, H. 1893.2.

For the stocking of trout streams, see below under Trout culture.

APPARATUS AND APPLIANCES**Including methods of use****Miscellaneous**

Filter apparatus. Borne, M. 1880.9; Jousset de Bellesme, G. 1899.1; Ransom, W. H. 1865.1. — *Tube for aerating water.*

Brass, J. L. 1907.1. — *Collecting tub, fish retainer, shipping case for eggs, etc.* Fuller, A. E. 1908.1. — *Methods and devices for counting eggs and fry.* Bayer, H. 1908.2; Borne, M. 1880.11; Green, A. 1905.1; La Valette St. George, A. 1902.1; Robinson, R. K. 1910.1. — *Shelter for fishes, "aquarisère."* Séré, E. 1867.1.

Fishways or passes

Salmon ladders, etc.; plans, directions for construction, etc. Baird, S. F. 1880.7; Baird & McDonald 1882.1; ★Bayer, H. 1908.1; Bitterli, S. 1910.1; Buck, W. O. 1913.1; Buckland, F. T. 1865.1, 1867.2; Cheney, A. N. 1898.2; Dyche, L. L. 1912.2; Fatio, V. 1888.1; Fastenau, — 1872.1, 1873.1; Francis, F. 1870.1; ★Gerhardt, P. 1904.1; Grieg, J. A. 1902.3; Hetting, M. G. 1866.4; Horsfall, J. H. 1867.1; Keller, H. 1885.1, 1887.1; Launay, M. 1901.1; Löschner, H. 1908.1, Add. 1908.1; ★McDonald, M. 1884.6; Prince, E. E. 1914.1; Raveret-Wattel, C. 1884.3, 1893.1; Scott, W. R. 1873.1; ★Violette, A. 1908.1; Widegren, H. 1867.1; Zdeborszky, K. 1880.1; Anon. 58, 437; ★Atkins, C. G. Add. 1873.1; Landmark, A. Add. 1884.1; Michaelis, K. Add. 1881.1; Riemann, J. F. Add. 1804.1.

Fishways in various localities. — *In Belgium.* Denil, G. 1909.1; Joly de Saully, — 1909.1. — *In France, Seine R.* Caméré, — 1901.1; *In Meuse and Ourthe Rivers.* Denil, G. Add. 1909.1. — *In Finland.* Juselius, — 1905.1; Nordqvist, O. F. 1892.3. — *In Germany.* Meyer, — 1879.1. *In Weser, at Bremen.* Hapke, L. Add. 1913.1. — *On Merrimac R.* Lyman, T. 1868.1. — *In Pitt R., Cal.* Throckmorton, S. R. 1882.1. — *In Pennsylvania.* Worral, J. 1875.1, 1876.1.

Hatching apparatus

Various papers on jars, troughs, and apparatus used in hatching operations. Chambers, W. O. 1889.2; Cicile-Brion, — 1866.1; Clark, F. N. 1908.1; Fullerton, S. F. 1909.1; Haack, H. 1879.8; Hein, W. 1906.1, 1908.1, 1909.1; Joly de Saily, — 1901.2; La Blanchère, P. 1877.2; La Valette St. G., A. 1879.1, 1882.1; Lönnberg, A. J. 1903.5; Mather, F. 1876.1; Meehan, W. E. 1907.2; Milner, J. W. 1878.1; Raveret-Wattel, C. 1895.1, 1896.2; Reisenbichler, G. F. 1880.2; Simms, G. E. 1912.1; Titcomb, J. W. 1910.1; Vincent, E. 1910.1, 2.

California or Williamson's (double riffle) hatching trough. For description and figure, consult Rept. U. S. Fish. Comm. 1872 (1874), II, pp. 547, 585, pl. XVI. — Use in Germany. Borne, M. 1878.2, 11, 1880.4, 7; Overbeck, G. 1879.2; Paul-Wusterbarth, — 1879.1.

Mechanical rotator for fish-hatching. Fabre-Domergue, P. & Biétreix, E. 1902.1.

Seth Green's shad hatching or floating box. Green, S. 1874.2; Add. 1874.1.

Holton's tray-hatching apparatus. Holton, M. G. 1874.1.

McDonald universal jar. McDonald, M. 1883.2; Nourse, T. 1898.1; Page, W. F. 1890.1, Add. 1898.1; Anon. 574.

Chester and McDonald tidal boxes for hatching cod. McDonald, M. 1880.1; Raveret-Wattel, C. 1886.1; Anon. 574.

Ferguson plunging buckets for shad hatching. Milner, J. W. 1880.3.

Clark "self-picking" hatching jar. Clark, F. N. Add. 1881.1.

Transportable hatching stations. Borne, M. 1878.12.13; Haack, H. 1878.7.

Food and Feeding-methods

See also various sub-headings below under Pisciculture by subjects, especially Trout culture.

Miscellaneous papers. Annin, J. 1879.1; Cheney, A. N. 1893.1, 1896.1; Day, F. 1883.3; Graefe, M. 1880.1; Haldehwang, A. 1880.2; Heckenstaller, 1879.2; Heynemann, B. A. 1902.1; Horak, W. 1876.1; Jousset de Bellesme, G. 1897.1; Knauth, K. 1899.2, 1900.1, 1902.1, Add. 1898.1, 2, 1900.1; Levander, K. M. 1901.4; Mather, F. 1879.3; Schinke, K. 1904.1; Wirth, F. 1871.1; Zuntz, N. & Knauth, K. 1900.1, 2; R., Add. 1911.1. — *Effects on egg production.* Thompson, W. T. 1903.1.

Proper foods for fry and young fishes. Baird, S. F. 1871.30; Forbes, S. A. 1880.3, 1903.2; Henshall, J. A. 1904.3; Herdman, W. A., Scott, A. & Johnstone, J. 1899.1, 1907.1; Hering, — 1871.1; Johnson, F. M. 1907.1; Millet, C. 1855.1.

Various kinds of food. — *Algæ as food.* Comère, J. 1904.1. — *Dry food.* Jaffé, S. 1902.2. — *Liver.* Mynster, W. A. 1880.2. — *Blood as food.* Henshall, J. A. 1903.2; Raveret-Wattel, C. 1892.1; Jousset de Bellesme, G. Add. 1895.1. — *Feeding with nudibranchs.* Herdman, W. A. Add. 1890.1.

Insects, both adult and larvæ, used as fish food. Atkins, C. G. (*fly-larvæ*) 1895.1, 1904.1, 1906.1; Buckenferde-Stempel, R. H. 1879.1; France, R. H. 1897.1; Klug, C. 1878.1; Levi-Morenos, D. 1901.1; Melsheimer, M. 1878.2 (*May-flies*); Proschowsky, A. R. 1901.1 (*Cock-roaches*); Raveret-Wattel, C. 1889.1, 1892.2.

Natural food. *Propagation or naturally increased production, or utilization of plankton and minute crustacea as source of food for pond fishes.* Knörrich, F. W. 1900.1; Kochs, W. 1892.2; Roule, L. 1908.1, 2; Sauvadon, G. 1867.1; Schermer, E. 1914.2; Schiemenz, P. 1905.3, Add. 1907.1; Schoch, G. 1894.3; Wanger, C. 1893.1; Weeger, E. 1900.1.

General and miscellaneous; desirability of natural food, etc. ★Daday, J. 1897.1; Hauck, J. 1904.1; Mason, F. H. 1893.1, Add. 1889.1; O'Brien, M. E. 1889.1; Raveret-Wattel, C. 1895.4; Schwaab, (Dr.) 1885.1, 2; Walter, E. 1896.1; Zuntz, N. & Cronheim, W. 1911.1; Cheney, A. N. Add. 1894.1; Istvenssi, J. Add. 1894.1.

For Aquatic plants, affording protection to natural food organisms, see Pond culture below.

Castration for fattening. *Observations on the methods of Samuel Tull.* Weddige, 1882.1; Sloane, H. Pre-Linn. 1745.1; Watson, W. Pre-Linn. 1754.1.

METHODS IN ARTIFICIAL FERTILIZATION

For methods used in the handling of particular species, see Pisciculture by subjects, below.

General account. Rusconi, M. 1854.1.

Determining if ova are impregnated. Nussbaum, M. 1883.1, 2. — *Separating live from dead eggs of salmon by use of salt solution.* O'Malley, H. 1906.1. — *Recording egg development.* Wallich, C. 1901.1.

Handling adhesive eggs; use of muck, starch, etc. Borne, M. 1878.1; Hessel, R. 1874.1; Mather, F. 1878.8; Reighard, J. E. 1891.1, 1893.1, Add. 1893.1; Strahan, J. 1894.1.

Regulation of temperature during hatching. Green, S. 1880.7; Schoch, G. 1892.2; Smith, H. M. 1904.6; Viguié, C. 1904.1.

"Russian" or dry method of fertilization. Reisenbichler, G. F. 1880.1, 1882.1; Stentzel, A. 1874.1; Stone, L. 1872.7; Anon. 574.

The Russian method which consists in the application of sperm to eggs without dilution, was originated by V. P. Vraschi in order to overcome the disadvantages of the very short life of spermatozoa after they have been placed in water. *For a further discussion of this subject, see Duration of virility under Spermatozoa.*

INTRODUCTION OF FISHES

throughout the world, with their occasional acclimatization

For the introduction of exotic species, purely as aquarium novelties, see under Aquaria, and under the various genera.

Various papers on the introduction and acclimatization of fishes. Chambers, W. O. 1883.1; Coste, J. J. 1874.1; Coste, P. 1854.1; D., H. D. 1879.1; Dagry, A. 1911.1; Gibbons, W. P. 1869.1; La Blanchère, P. R. 1874.3; Maitland, J. R. 1883.1, 1892.1; Mill, N. 1825.1; Noël de la Morinière, S. 1800.1; Smith, H. M. 1905.2.

Review of results in the Pacific States of the U. S. ★Smith, H. M. 1896.3.

Methods of transportation of eggs and fishes

Eggs; directions for transportation with methods of packing in wet moss, ice caps, dry-packing, etc. Baird, S. F. 1879.9; Behr, S. 1882.1; Borne, M. 1880.5, 6, Add. 1882.1; Eckardt, R. 1879.2, 3, 5; Green, S. 1875.6; Haack, H. 1878.8; Hubbard, W. F. 1904.1; Huske, C. J. 1884.2; Lindon, E. V. 1869.1; Mather, F. 1891.2; Millet, C. 1855.3; Page, W. F. 1887.1; ★Titcomb, J. W. 1910.1; ★Anon. 574.

Pisciculture — Cont'd.

Live fishes; directions for transportation of living fishes (chiefly fry). Altazin, E. 1901.1; Buckenferde-Stempel, R. 1878.2; Carbonnier, P. 1871.1, 1873.2; Cheney, A. N. 1885.1, 1896.2, 3; ★Dagry, A. 1911.1; Figuier, G. L. 1858.1 (vi); G., W. 1841.1; Golusda, P. 1912.7; Gray, J. E. 1868.3; ★Holder, C. F. 1908.3; ★Kaltenegger, F. 1906.1; ★Kincaid, W. S. 1910.1; Köttl, J. 1878.1; ★La Blanchère, P. 1869.2; Lloyd, W. A. 1876.2; Maison, E. 1906.1; Malmgren, H. 1887.1; Malwitz, — 1779.1; ★Mead, A. D. 1908.1, 1909.1; Meyer, J. 1878.1; Milner, J. W. 1876.1; Morgan, I. 1878.1; Seal, W. P. 1892.2; Sweeny, R. O. 1878.1; Stone, L. Add. 1880.1. — *Use of oxygen in sealed jars.* Osburn, R. C. 1910.8. — *Haplomus playfairii, from Seychelles to Paris in glass bottle.* Wright, E. P. 1868.2. — *Carp packed in wet moss.* Duke, R. T. Add. 1884.1.

Apparatus; containers, tanks, etc. used in transporting live fishes. Belousov, N. 1906.1; ★Bettoni, G. 1901.1; Borne, M. 1884.5; Bristol, C. L. 1903.1; Curle, T. J. 1875.1; Friedrich, J. 1905.1, 1907.1; Goenry, — 1902.1. — *Danger of infection from shipping cans.* Marsh, M. C. 1905.1.

Details of fittings of R. M. S. "Oroya" used in transport of plaice from England to Australia. ★Dannevig, H. C. 1902.2.

Introduction of Bass and Sunfish

Black bass. (Chiefly large-mouthed, from U. S. Fish Comm.) *Introduction into England.* Arielson, — 1872.1; Goode, G. B. 1883.17; Hensman, J. T. 1884.1 (Nene R.); Silk, M. 1880.1. — *into Finland.* Nordqvist, O. Add. 1894.1. — *into France.* D'Arenberg, P. 1911.1. — *into Germany.* Borne, M. 1883.1, 2, 1884.2, 3, 1886.1, Add. 1882.1; Surbeck, G. 1905.2. — *into Balaton lake, Hungary.* Vutskits, G. 1910.1, 2. — *into Italy.* Besana, G. 1908.1; Supino, F. 1912.2. — *into Sweden.* Hintze, A. 1888.1, 1893.3. — *into the Philippine Is.* Seale, A. 1910.3.

Calico bass. *Introduced into France.* Gensoul, J. 1913.1; Anon. 690. — *into Germany.* Borne, M. 1893.2, 1901.1; Debschitz, H. 1901.1. — *into Italian lakes.* Supino, F. 1912.2.

Rock bass. *Introduced into France.* Gensoul, J. 1910.1; Raveret-Wattel, C. 1910.1. — *into Germany.* Borne, M. 1893.2.

Sunfish, American. *Eupomotis gibbosus into Germany.* Bergner, J. 1906.1. — *into France.* Künstler, J. 1908.1; Letacq, A. L. 1910.1; Maingaud, E. 1900.1. — *into Italy.* Mazzarelli, G. F. 1909.2.

Lepomis megalotis in France. Bouvet, G. 1900.1; Olivier, E. 1901.2. — *Lepomis auritus in Italy.* Bellotti, C., Ronchetti, — & others. 1905.1; Besana, G. 1908.1; Natoli, R. 1905.1.

Introduction of Carp

Carp of Tibet introduced in Italy. Bonafous, C. 1827.1.

Africa. *Introduction into Algeria.* Cosson, E. S. 1862.1. — *in Tananarivo, Madagascar.* Dagry, A. Add. 1914.1.

America. *History of the introduction of carp into the United States.* ★Cole, L. J. 1905.1; Smiley, C. W. 1883.8, 1884.4.

First carp brought to the U. S. by Capt. Henry Robinson of Newburgh, N. Y., about 1830, some were liberated in Hudson R. Philips, B. 1883.2; Redding, J. D. 1884.1; Shears, E. E. 1882.1. — *First successful introduction from Holstein to Sonoma Co., Cal., by J. A. Poppe in 1872.* Poppe, R. A. 1880.1. — *First introduction by U. S. Fish Comm., through carp brought from Bremen by Rudolph Hessel in 1877.* Baird, S. F. 1879.10; Goode, G. B. 1880.7; Hessel, R. 1883.1. — *Second introduction by U. S. Fish Comm. of 100 mirror carp from Dr. Eckhardt of Lübbinchen.* Finsch, F. H. 1882.1, 2. — *Early distribution by U. S. Fish Comm. throughout the United States.* McDonald, M. 1883.1, 1884.7, 9; Smiley, C. W. 1884.13.

Central and South America; Carp sent to Brazil. Couchman, J. W. 1883.1; Smiley, C. W. 1885.2. — *Carp sent to Cuba, Mexico and Hawaiian Is. from U. S.* Smiley, C. W. 1884.2.

Introduction of Catfish

American catfish (three species) introduced into California in 1874, by L. Stone. Smith, H. M. 1896.3. — *Catfish from Potomac put in Colorado R., Arizona, 1884.* McDonald, M. 1884.12.

American bullhead or horned pout (Ameiurus nebulosus), sent in 1885 to England, France, Germany and Netherlands. Smiley, C. W. 1885.4. — *Ameiurus, proposed introduction into Belgium.* Lefebvre, A. 1883.1; Willequet, E. 1883.1, 2; Wilson, T. 1882.1. — *Ameiurus introduced into France.* Bellesme, J. 1886.1; Chappellier, A. 1907.1; Fuhrmann, O. 1903.2, 1905.2; Künstler, J. 1907.1, 1908.1; Lavauden, L. 1905.1; Lavollée, G. 1906.1; Letacq, A. L. 1906.1, 1909.1, 2; Meugnot, A. 1908.2; Pion-Gaud, P. 1904.1; Pion-Gaud, P. & Lavauden, L. 1904.1; Robertson-Proschowski, A. 1904.1; Rollinat, R. 1910.1. — *into Germany.* Borne, M. 1891.1. — *into Italy.* Mazzarelli, G. F. 1909.2; Meschinelli, L. 1907.1. — *into New Zealand.* Ayson, L. F. 1908.1.

European catfish (Silurus glanis) introduced into England. Sachs, T. R. 1880.1; Stricker, W. 1869.1; Anon. 395. — *into France, Valenciennes, A. 1851.1, 2, 1855.1.*

Introduction of Gourami

Gourami (Osphromenus olfax), introduction into various countries. ★Gill, T. N. 1874.3; Ruz de Lavison, E. 1861.1; Anon. 535. — *into France.* Baird, S. F. 1871.22, 1875.19; Barthélemy-Lapommeraye, — 1863.5, 1865.1; Carbonnier, P. 1869.1, 2; Coste, P. 1865.1; Dabry de Thiersant, P. 1868.1; Vinson, A. 1861.1; Anon. 408; Sicard, A. Add. 1872.1; Saulcy, E. Add. 1861.1. — *into Algeria.* Vinson, A. 1861.1. — *into Ceylon.* Pert-

wee, A. H. 1911.1. — *Acclimatization in Reunion Islands*. Vinson, A. 1861.1. — *Introduction (proposed) in Italy*. Doderlein, P. Add. 1867.1. — *Introduction into Japan*. Tanaka, S. & Yoshinaga, T. Add. 1914.1.

Introduction of Salmon and Trout

Brook trout. *American*, (*Salvelinus fontinalis*). *Introduction into California, of trout from New Hampshire*. Bean, T. H. 1911.6. — *introduced in Austria*. Franke, J. 1908.1; Pirko, F. 1908.1. — *in England*. Chambers, W. O. 1889.1; Anon. 40. — *in Finland*. Nordqvist, O. F. 1899.12. — *in Germany*. Behr, S. 1883.1; Borne, M. 1879.2, 1885.1; Haack, H. 1880.4, 9. — *in Sweden*. Hammarström, C. 1901.1; Lönnberg, A. J. 1905.1, 2, 8. — *(recommended) for Switzerland*. Goll, H. 1887.1. — *in Tasmania*. Seager, P. S. 1888.1.

California or Quinnat salmon. (*Ova*), *sent to South Africa*. Baird, S. F. 1876.24. *Attempts at introduction in waters of eastern North America*. Baird, S. F. 1873.31; Slack, J. H. 1876.1; Webber, S. 1878.2. — *in New York*. Baird, S. F. 1874.13. — *in Sunapee Lake, N. H.* Evermann, B. W. 1906.12, 1907.3; Kendall, W. C. 1914.1, also in ★Rept. U. S. Fish Comm., 1912. (1914) — *in Lake Geneva, Wis.* Fairbank, N. K. 1880.3, 1881.1. — *into Mississippi R. near Memphis*. McDowell, W. W. 1878.1; Will, 1879.1. — *in New Jersey*. Peirce, M. P. 1877.2. — *in Lake Ontario*. Robson, J. J. 1878.1; Smith, H. M. 1899.1; Wilmot, S. 1882.1, 2. — *in Susquehanna R., Pa.* Clapp, A. F. 1893.1; Worral, J. 1873.1. — *in Great Salt Lake, Utah*. Rockwood, A. P. 1876.1. — *in Louisiana*. Bean, T. H. Add. 1882.1.

Introduction into Chile, S. A. Albert, F. 1902.1, 1906.1, 1907.1; Cerda, J. 1885.1; Sage, C. 1912.1; Smith, W. A. 1897.2.

Attempts at introduction into Europe. — *in Austria, Galicia*. Nowicki, M. 1880.3. — *in British Isles*. Baird, S. F. 1879.7; Mather, F. 1879.1, 1880.4. — *in France*. Baird, S. F. 1879.7; Daguin, — 1893.1 (*Haute-Marne R.*); Fage, L. 1912.1, 2 (*recommended for Mediterranean rivers*); Jousset de B., G. 1897.2, Add. 1891.1; Marion, A. F. & Guitel, F. 1890.1; Maslieurat-Lagémard, — 1884.1; Mather, F. 1879.1, 1880.4; Raveret-Wattel, C. 1880.1, 2; Valéry-Mayet, — 1884.1, 1885.1; Berthoule, A. Add. 1889.1. — *in Germany*. Baird, S. F. 1879.7; Eckhardt, R. 1879.1; Haack, H. 1878.3, 4, 1879.4; Jaffé, S. 1896.1; Mather, F. 1879.1, 1880.4; Anon. 73. — *into Lake Castel Gandolfo, Italy*. Vinciguerra, D. 1893.3, 1896.2; *Failure of introduction in Italy*. Besana, G. 1908.1. — *in Netherlands*. Baird, S. F. 1879.7; Bottemanne, C. J. 1880.1; Hegt, J. N. 1880.1; Mather, F. 1879.1, 1880.4.

Introduction into Australia. Baird, S. F. 1873.4, 1876.25; Philips, B. 1874.3; ★Wilson, S. 1878.1, 1879.1.

Introduction into New Zealand. Baird, S. F. 1873.47, 1876.23; Howard, H. 1876.1; ★Nicols, A. 1882.1 (*Gen. treat.*); Rutherford, A. J. 1901.1; Stewart, J. 1876.1; Vion, R. 1879.1; Anon. 68; Farr, S. C. Add. 1883.1. — *For correspondence relating to transmission of eggs of Quinnat salmon to New Zealand, 1875 to 1878, see Rept. U. S. Fish Comm., 1875-76 (1878), IV, 959-1003, and 1878 (1880), VI, 825-905.*

Other American salmonids introduced. *Steelhead trout* (*Salmo gairdneri*), *acclimated in Great Lakes*. Bean, B. A. 1902.3; Evermann, B. W. 1907.6; Smith, H. M. 1899.1.

Silver or Coho salmon (*Oncorhynchus kisutch*) *planted in Maine*. Evermann, B. W. 1905.4.

Sending of Salmo mykiss macdonaldi from Colorado to Germany. Jaffé, S. 1902.1; Persico, P. 1903.1.

Lake Tahoe trout (*Salmo henshawi*), *details of original distribution in Sierra Nevada of California as altered by man*. Jordan, D. S. 1901.5, 1904.5.

Atlantic salmon (*Salmo salar*). *First introduction of ova from New Brunswick to New England, 1866*. Edmunds, M. C. 1873.1. — *Various plantings in waters of New Jersey and New York*. Bean, T. H. 1890.28; Mather, F. 1884.3, 1889.4, 1890.1; Norris, T. 1872.1, 1874.6; Slack, J. H. 1874.2; Ward, F. M. 1887.1. — *in Wisconsin*. Douseman, H. F. 1874.1. — *in New Hampshire*. Fletcher, W. W. 1874.1. — *introduced on Pacific coast*. Smith, H. M. 1896.3.

Landlocked salmon put into Woodhull lake, N. Y. Green, S. 1882.2. — *sent to Argentina*. Tulian, E. A. 1910.1, Add. 1911.1.

European salmon. *Rhine salmon planted in Lake Geneva*. Chavannes, A. 1869.1, 2, 1870.1; Figuier, G. L. 1858.1 (vi). — *in Ticino R., Italy*. Pavesi, P. 1886.1. — *in the Danube*. Anon. 75. — *sent to the U. S., 1872*. Baird, S. F. 1874.27; Goode, G. B. 1881.2.

Danube salmon ova (*Salmo hucho*), *sent to America*. Hessel, R. 1874.2.

Salmon (*S. salar*) *introduced in Mediterranean rivers of France*. Gervais, F. L. 1861.1, 1862.1. — *Possibility of acclimating in Marne*. Roger Desgenettes, — 1863.1.

Salmon ova (*S. salar*) *from England and Scotland taken to Australia*. Johnson, T. 1864.1, 1865.1; Ramel, P. 1864.1; Siebold, C. T. 1869.1; Watts, H. E. 1868.1; Anon. 21, 486.

Numerous attempts beginning in 1864 to acclimate English salmon in Tasmania. ★Allport, M. 1864.1-1878.1; Dannevig, G. M. 1885.3; Günther, A. C. 1872.11; Johnston, R. M. 1888.1; Kent, W. S. 1887.1; ★Nicols, A. 1882.1; Piquenit, W. C. 1867.1; ★Seager, P. S. 1888.1, (*History*); Soubeiran, J. L. 1870.1, 4; Anon. 19, 485; Brady, T. Add. 1888.1.

Pisciculture — Cont'd.

— in *New Zealand*. Ayson, L. F. 1908.1; Anon. 20.

European trout. (*Brown trout*, *Loch Leven trout*, and *Sea trout* are now considered one species, *Salmo trutta*.)

Trout introduced into Cape Colony, Africa. Raveret-Wattel, C. 1903.1, 1904.2. — *into Natal, Africa.* Feilden, H. W. Add. 1893.1. — *into the U. S.* McDonald, M. 1887.10; Marston, R. B. 1896.1; Mather, F. 1889.1; Smiley, C. W. 1889.1; — *in California.* Jordan, D. S. 1905.2. — *into India.* Day, F. 1876.4; Smythies, E. A. 1910.1. — *into Tasmania.* Allport, M. 1866.1, 1869.5, 1870.1, 2, 3, 1871.1; Seager, P. S. 1888.1; Anon. 21. — *into New Zealand.* Arthur, W. 1879.1, 1883.5, 1884.3; Anon. 544. — *Where to catch trout in New Zealand.* Spackman, W. H. 1892.1. — *Native fish causing disappearance.* Ferguson, A. Add. 1889.1.

Lake trout. *American*, (*Cristivomer namaycush*). *Introduced in Argentina,* S. A. Tulian, E. A. 1910.1. — *in England.* Fennell, H. 1885.1. — *in France.* Banmeyer, — 1884.1. — *in Switzerland.* Delachaux, T. 1895.1.

Rainbow trout. *American*, (*Salmo irideus*). *Introduction in Austria.* Pirko, F. 1908.1; Salomon, K. 1906.1. — *in England.* Chambers, W. O. 1889.1; Fennell, H. 1885.1. — *in Finland.* Nordqvist, O. F. 1895.7, 1896.8. — *in France.* Audeville, A. 1888.1; Cligny, A. 1912.3; Lefebvre, A. 1896.1; Letacq, A. L. 1900.1; Marcillac, A. 1896.1–1900.1; Mocquard, F. 1911.1; Oltramare, H. 1897.1, 2. — *in Germany.* Arens, C. 1898.1, 1906.2; Borne, M. 1885.1; Coester, O. 1907.1; Herrmann, W. 1907.1; Hofer, B. 1907.1; Pressel, W. 1906.1, Add. 1900.1; Sieglin, H. 1892.1, 1905.1; Musseleck, G. Add. 1902.1. — *in Italy.* Besana, G. 1908.1; Cecconi, G. 1904.1. — *in Sweden.* Hammarström, C. 1901.1; Hintze, A. 1895.1; Lönnberg, A. J. 1905.1, 2, 8. — *in Switzerland.* Surbeck, G. 1913.2. — *in Japan.* Akekio, S. 1882.1; Kishinouye, K. 1904.1. — *in New Zealand.* Ayson, L. F. 1908.1.

Introduction in waters of eastern United States: *Michigan.* Bower, S. 1910.1; Clark, F. N. 1883.4; Metcalf, M. 1883.1. — *Missouri.* Maynard, H. J. 1889.1. — *New Hampshire.* Johnson, F. M. 1905.1. — *New York.* Bean, T. H. 1896.2; Farnum, C. A. 1879.1; Green, S. 1878.1, 2, 1879.1; Long, W. 1879.1.

Saibling. *Charr* or "*Ombre Chevalier*" of *Alpine Lakes* (*Salvelinus alpinus*). *Introduced in Chile,* S. A. Albert, F. 1902.1, 1906.1, 1907.1; — *in France.* Rico, B. 1877.1. — *in Italy.* Filippi, F. 1861.2. — *in New Zealand and Tasmania.* Siebold, C. T. 1868.1, 1869.1; Anon. 21, 22.

Introduction of Shad

American or common shad; successful acclimatization in California. First fry planted in *Sacramento R.* by Seth Green, in 1871. Baird, S. F. 1873.37, 40, 1876.5,

1880.6; Lang, W. 1879.2; Mather, F. 1878.1; Milner, J. W. 1874.4; Porter, B. B. 1878.3; ★Smith, H. M. 1893.1, 1896.3; Throckmorton, S. R. 1873.1, 2, 1874.2; Anon. 305. — *Second lot transferred from Hudson to Sacramento, in 1873.* Stone, L. 1874.3, 9.

Introduction into Oregon. Finely, C. I. 1884.1.

Shad planted by U. S. Fish Comm. in Ohio and Mississippi Rivers. Baird, S. F. 1873.2, 38, 1876.27, 1877.1; Clift, M. 1874.1; Green, S. 1874.8; Philips, B. 1874.9; Smiley, C. W. 1883.7.

Introduction of American shad into Germany. Finsch, F. H. 1876.1; Wengen, — 1877.2.

Introduction of striped bass in California

Accounts of first planting of young in San Francisco Bay, in 1879. Baird, S. F. 1880.6; Mason, H. W. 1882.1; Stone, L. 1882.3; Throckmorton, S. R. 1882.2. — *Review of the successful acclimatization.* ★Smith, H. M. 1893.1.

Introduction of Whitefish

European whitefish. *Madue Maræne* (*Coregonus maræna*) brought from Germany and placed in *Gardner's Lake, Michigan*, in 1877. Baird, S. F. 1878.7, 1879.10; Goode, G. B. 1881.2.

Maræne (*C. maræna*) from northern Germany, introduced in lakes of Bavaria, etc. Haack, H. 1878.1, 1879.7; Hofer, B. 1905.1; Surbeck, G. 1905.4, 1907.1.

Blaufelchen (*C. wartmanni*) introduced in Italy. Besana, G. 1897.1; Filippi, F. 1861.2; Pavesi, P. 1886.1; Vinciguerra, D. 1895.1.

American whitefish. Eggs shipped from *Clarkston, Michigan*, to *California* in 1872 (*Unsuccessful results*). Goode, G. B. 1881.2; Milner, J. W. 1874.4; Stone, L. 1874.3; Smith, H. M. 1896.3.

Introduction in France. Banmeyer, — 1884.1. — *in England.* Fennell, H. 1885.1. — *in Germany, Bavaria.* Borne, M. 1885.1. — *in Switzerland.* Frey, E. 1885.1; Mason, F. H. 1883.1.

Transmission of eggs to Australia and New Zealand. Baird, S. F. 1879.10; Greenfield, A. 1884.1; Whitcombe, W. P. 1885.1. — *For correspondence relating to this transmission in 1875–1878, see Rept. U. S. Fish Comm. 1875–76 (1878), IV. 959–1003, and 1878 (1880), VI. 825–905.*

Various fishes introduced

Australian bass (*Percaletes fluviatilis*) taken from *New South Wales* to *Fiji*. Stead, D. G. 1914.1.

Barbus in *Sig River, Algeria.* Naudin, A. 1907.1; Raveret-Wattel, C. 1913.1.

Burbot in *Lake Geneva, Switzerland.* Forel, F. A. 1900.2.

Carp sucker in *New South Wales.* Bean, T. H. 1889.8.

Grayling in waters of eastern United States. Norris, T. 1876.1.

Mullet (Jamaican) proposed for United States. Bean, T. H. 1890.26, 1891.17.
— *Mullet (Hawaiian) proposed for U. S.* Miller, J. F. 1884.1.

Orfe (Idus) in England. Raveret-Wattel, C. 1874.1; Anon. 306.

Perch (Yellow perch) introduced in California. Smith, H. M. 1896.3; Stone, L. 1874.4. — *Introduction (proposed in North Dakota).* Pope, T. E. 1908.1.

Plaice transferred from Barents Sea to North Sea. Atkinson, G. T. 1909.1, 1910.1. — *Transplantation of inshore plaice to Dogger Bank.* Borley, J. O. 1912.2. — *Plaice and sole from England introduced in Australian waters.* Dannevig, H. C. 1902.2. — *Plaice introduced into Plöner sea.* Duncker, G. 1894.1.

Sander or Pike-perch (Lucioperca sandra) of Germany introduced in England. Dallmer, E. 1879.3; Sachs, T. R. 1880.1. — *in France.* Valenciennes, A. 1851.1. — *in Norway.* Huitsfeldt-Kaas, H. 1906.1.

Sole, attempted introduction in American waters. Baird, S. F. 1884.1 (p. liv); Goode, G. B. 1880.19; Mather, F. 1878.3, 1879.2; Moore, T. J. Add. 1889.1.

Tench introduced in Algeria. Cosson, E. S. 1862.1. — *in Chile.* Albert, F. 1906.1. — *in India.* Day, F. 1876.4. — *in Sweden.* Trybom, F. 1887.3.

Top-minnows (Pæciliidæ) for mosquito destruction. *Gambusia affinis* introduced in *Hawaiian Is.* Seale, A. 1905.1; Van Dine, D. L. 1900.1. — *in Philippines.* Seale, A. in *Philippine Journ. Sci.*, 1917, XII, Sect. D, p. 177-187. — *Lebistes reticulatus* in *Cape Colony, Africa.* Gilchrist, J. D. 1913.2.

Proposed introduction of the "Pejerrey" (Atherinichthys bonariensis) of Argentina into France. Iches, L. 1910.1.

NOXIOUS ORGANISMS

For organisms parasitic upon fishes, see under *Parasites*. For the voracity of fishes such as sharks, caribe, etc., and accounts of attacks upon men, see *Predatory fishes*.

Fish-eating plants

Delachaux, T. 1894.1; Halpérine, E. 1885.1; Walter, E. 1894.1. — *Bidnes cernua.* Lorenz, O. 1880.1.

Bladderwort (Utricularia) catching young fishes. Dean, B. 1889.1; Forbes, S. A. 1884.2; Moseley, H. N. 1884.1; Simms, G. E. 1884.1; Harting, J. E. Add. 1906.1.

Piscivorous animals

Miscellaneous papers on fish enemies. Allport, M. 1864.4; Ambrose, J. 1890.1; Annin, J. 1882.1, Add. 1884.1; Benecke, B. 1886.3; Hintze, A. 1900.1; Hofmann, E. 1884.1; Keene, J. H. 1877.1; La Valette St. George, A. 1879.2, 1880.1; Lindes, L. 1880.10; McGovern, H. D. 1880.1; Meyer, J. 1881.1; Mortensen, O. T. 1896.1; Pfyffer, L. 1885.1; Prince, E. E. 1914.2; Reuss, H. 1906.2; Löwe, — Pre-Linn. 1718.1.

Means of capture or destruction. Borne, M. 1880.1; Claparède, A. 1885.1; Pieper, A. 1878.1; Walter, E. [n. d.]. — *Destroying leeches.* Plehn, M. Add. 1898.1. — *Copper sulphate for destroying obnoxious fishes.* Titcombe, J. W. Add. 1914.1.

Invertebrates. Milner, J. W. 1877.2. — *Leeches.* Baster, J. 1762.2; Mokà, T. 1904.1; Verrill, A. E. 1874.2. — *Hydra destroying trout fry.* Beardsley, A. E. 1904.1; Schuberg, A. 1905.1. — *Fish-eating corals of Galapagos.* Jenyns, L. 1842.1. — *Snails.* K. — 1861.1. — *Actinæ, power of killing their prey.* Macdonnell, R. 1857.1, 2. — *Whelks, means of combating.* Petersen, C. 1911.1. — *Shrimps.* Corvinus, G. L. Pre-Linn. 1715.1.

Spiders killing fish. Peters, T. M. 1876.1; Spring, E. A. 1860.1.

For a popular article, containing reprints of all the original accounts (5 in number) of spiders killing fish, see E. W. Gudger in *Natural History (Journ. Amer. Mus.)* 1922, vol. 22, pp. 565-568.

Insects. Raveret-Wattel, C. 1889.1, 1892.2; Richardson, R. Pre-Linn. 1734.1. — *Bugs. (Belostomidæ.)* Dimmock, G. 1886.1; Putnam, F. W. Add. 1888.1. — *Mosquitoes.* Murray, C. H. 1885.1. — *Beetles.* Riley, C. V. 1885.1; Kulmus, J. Pre-Linn. 1719.1. — *Fly larvæ.* Schuberg, A. 1914.1. — *Corixa ovivora (Hemipteron) destroying fish ova in India.* Thomas, H. S. 1871.1.

Fishes. As destructive to other fishes. Keene, J. H. 1879.1; McIntosh, W. C. 1902.1; Anon. 554. — *Gar-pike.* Caldwell, E. E. 1913.1; Hussakof, L. 1914.1. — *Dogfish. (Marine.)* Collins, J. W. 1884.3; Warren, R. 1882.1; Prince, E. E. Add. 1904.1. — *Haddock feeding on eggs of herring.* Duge, F. 1903.1. — *Carp.* Gurney, J. H. 1860.1; Ryder, J. A. 1884.2. — *Pickarel.* E., W. W. 1874.1. — *Bass.* G., — von. 1877.1. — *Lampreys.* Gage, S. H. 1894.1, 1898.1, 1899.1; Robertson, D. 1875.1; Anon. 612. — *Goldfish.* Green, S. 1878.8. — *Plecoglossus injuring other fishes.* Kishinouye, K. 1895.2. — *Roccus lineatus feeding on menhaden.* Mosher, G. 1883.1. — *Methods of extermination.* Prince, E. E. Add. 1905.2.

Amphibians and reptiles. *Snakes catching fish.* Annin, J. 1882.1; Hessel, R. 1884.2; Malmer, H. 1895.1; Sterling, E. 1880.2; Warner, J. S. 1884.1; Nye, W. Add. 1883.1. — *Cryptobranchus destructive to spawn.* Clarke, G. 1873.1. — *Toads destroying fishes.* Duchemin, E. 1870.1, 2, 3; Förster, C. 1873.1; Jenkins, C. 1870.1; Lankester, E. R. 1870.1. — *Reptiles.* Rollinat, R. 1902.1. — *Crocodiles.* Woods, J. E. 1881.1.

Birds. McIntosh, W. C. 1903.2; Schalin, Z. 1883.1; Warren, B. H. 1897.1; Rhead, L. Add. 1908.1. — *King-fisher.* Annin, J. 1882.1; Nichols, J. T. 1915.5; Plocq, E. 1907.1. — *Swans destroying spawn.* Bambridge, B. R. 1879.1; Plummer, R. 1879.1; Forel, A. H. Add. 1900.1. — *Water-ouzel.* Horsfall, J. H. 1863.1;

Pisciculture — Cont'd.

Clutterbuck, J. W. Add. 1863.1. — *Grebes*. Maurer, — 1895.1; Trybom, F. 1902.1, 2. — *Gulls*. Maurer, — 1895.1; Poncy, R. 1911.1. — *Cormorant*. Panchaud, E. 1911.1; Poncy, R. 1911.2. — *Osprey*. Schlegel, H. & Müller, S. 1839.2. — *Grackles*. Elliott, H. W. Add. 1890.1. — *Ducks*. Killinger, A. Add. 1913.1. — *Bee-eaters as fish-eaters*. Reeves, E. G., Willey, A. & Green, E. E. Add. 1910.1.

Mammals. Annin, J. 1882.1; Warren, B. H. 1897.1. — *Shrew*. Brehm, C. L. 1830.1. — *Weasel*. Delachaux, T. 1895.2. — *Skunk*. Mesmer-Weber, J. 1895.1. — *Otter*. Puenzieux, A. 1894.1. — *Muskrat*. Carpenter, C. Add. 1884.1; Elliott, H. W. Add. 1884.1; Merriam, C. H. Add. 1884.1. — *Bats eating fishes*. Harting, J. E. Add. 1906.1. — *Seals injuring Baltic fisheries*. Hinkelman, — Add. 1887.1.

POND CULTURE

See also below under Bass, Carp, Trout and similar fishes which are ordinarily reared in ponds.

General treatises. *Rearing of fishes in ponds, with methods, proper fishes, construction of ponds, etc.*

Text in English. Albin, E. 1794.1; Boccius, G. 1841.1, 1848.1; Buckland, F. T. 1881.1; Hoare, J. 1870.2; ★Meehan, W. E. 1913.1; ★Townsend, C. H. 1906.1.

Text in French. Dubois, L. 1824.1; Leblanc, — 1787.1; Puvis, A. 1844.1; ★Raveret-Wattel, C. 1904.1; Rougier de la Bergerie, — 1819.1.

Text in German. Ackerhof, A. D. 1869.1; Benecke, B. 1886.5, 1889.1; Berisch, C. L. 1794.1; Biermann, A. 1865.1; Biesenbach, R. 1897.1; ★Borne, M. 1891.2, 1895.2, 1897.1, 1904.1; Cancrin, F. L. 1791.1; Debschitz, H. 1901.3; Delius, A. 1874.1; Hermann, C. G. 1795.1; Hömberg, W. 1902.1; Neu, J. F. 1859.1; ★Nicklas, C. 1881.1, 1898.1; Schinke, K. 1902.1; Schroeder, E. A. 1889.1; Stölter, G. F. 1859.1, 1860.1; ★Vogel, P. 1898.1, 1909.1; Wagner, G. J. 1762.1, 1785.1; Weber, F. E. 1901.1; Riemann, J. F. Add. 1798.1; ★Taurke, F. Add. 1908.1.

Text respectively in Swedish and Russian. Lindstedt, P. 1911.1; Sikorskij, V. L. 1905.1.

Aquatic plants for ponds. *Value, proper kinds, etc.* Brakeley, J. H. 1884.1; Green, C. K. 1905.1; Guerne, J. 1897.1; Lamiral, E. 1851.1; Leonhardt, E. E. 1904.11; Schiemenz, P. 1905.1; Schikora, F. 1899.1; Ward, L. F. 1883.1, 2; Titcombe, J. W. Add. 1909.1. — *Protecting shores by planting reeds, cane, etc.* Müller, — 1877.2. — *Treatment for removal of algæ.* Robinson, R. K. 1910.1.

Miscellaneous: *Papers on pond culture methods, construction, etc.*

Text in English. Baird, S. F. 1873.7, 49; Bean, T. H. 1897.1; Dyche, L. L. 1914.2;

Evermann, B. W. 1906.9; Lauman, F. A. 1910.1; Leary, J. L. 1905.1; Marshall, C. 1800.1–1805.1; Miller, P. 1810.1; Mordant, J. 1761.1; North, R. 1794.1, 1835.1; Townsend, C. H. 1914.1, Add. 1913.7; Worth, S. G. 1884.1; Anon. 239; Buck, W. O. Add. 1914.1; Leary, J. L. Add. 1905.1; Mather, F. Add. 1900.1. — *Device for improving water circulation.* Stead, D. G. 1914.2.

Text in German. Arens, C. 1896.1; Dyhrn, E. 1782.1; Gerhardt, P. 1904.1; Haempel, O. 1912.2; Haldenwang, A. 1880.2; Janke, H. 1878.1; Kuhnert, R. 1909.1; Leuchs, J. C. 1862.1; Neresheimer, E. 1911.4; Schneider, G. 1910.4; Anon. 549; Cancrin, F. L. Add. 1791.1; Herrmann, M. C. G. Add. 1791.1; Radermacher, D. Add. 1773.1; Tiburtius, T. Add. 1758.1. — Add. 1775.1.

Early works on the construction and care of fish ponds. *References to be found in Pre-Linn. section.*

Early general treatises, books, etc. Chaufour, J. 1618.1; Conringius, H. 1671.1; Crescentius, P. 1548.1; Dubravus, J. 1547.1, 1599.1; Estienne, C. 1554.1; Hagen, J. L. 1727.1; Hale, T. 1756.1; Heresbach, C. 1750.1; Jacob, G. 1717.1; North, R. 1713.1; Wagner, G. J. 1729.1.

Miscellaneous early papers on ponds and pond culture. Abbondio, G. 1715.1; Cato, M. P. 1581.1; D., L. B. 1717.1; Flemming, H. F. 1724.1; Heger, J. 1727.1; Palladius, R. T. 1543.1; Seger, J. L. 1727.1; Serres, O. 1600.1; Steinbock, E. F. 1730.1; Taverner, J. 1600.1; Thiemen, J. C. 1682.1; Tiburtius, T. 1757.1; Werlosching, J. B. 1750.1.

Pisciculture by subjects

For descriptions of the methods employed in magnitude by the U. S. Bureau of Fisheries, the reader should consult "A manual of fish-culture." ★Anon. 574, Revised edition, Doc. 345, 1900. See also ★Titcomb, J. W. 1910.1.

Anchovy culture

In the Netherlands. Hoek, P. 1891.2; Hoek, P. & others. 1886.1; Redeke, H. C. 1913.1, 1914.1.

Black Bass culture

Comprising both large mouth and small mouth black bass.

General discussion of methods in bass culture. Lydell, D. 1904.1; ★Page, W. F. 1894.2; Titcomb, J. W. 1910.1; ★Anon. 574.

Special topics: Experiments in artificial fertilization. Bower, S. 1897.1. — *Artificial bass nest.* Fuller, A. E. 1908.1. — *Plan for bass ponds.* Lambert, E. M. 1905.1. — *Assorting fry to prevent cannibalism.* Stranahan, J. J. 1907.1, 1909.1. — *Feeding young bass.* Carter, E. N. Add. 1914.1.

Miscellaneous: Various notes on bass culture. Arnold, I. 1883.1; Bean, T. H. 1889.2; Beeman, H. W. 1907.1; Borne, M. 1885.4, 1886.1, 1887.1; Burrows, C.

A. 1875.1; Cecil, W. A. 1885.1; Clark, F. N. 1906.1; Dean, H. D. 1903.1; Green, S. 1877.1, 1884.1; Henshall, J. A. 1884.3; Hyde, J. F. 1874.1; Leary, J. L. 1904.2; Lovejoy, S. 1905.1; ★Lydell, D. 1903.1-1907.1, Add. 1911.1; Nesley, C. H. 1914.1; O'Brien, M. E. 1889.1; Prince, E. E. 1898.3; Raveret-Wattel, C. 1911.1; Reighard, J. E. 1906.1; Ripple, R. 1909.1; Roosevelt, R. B. 1879.2; Stebbins, B. M. 1880.1; Walderdorff, W. 1901.1; Anon. 169; Buller, Wm. Add. 1905.1; Stranahan, J. J. Add. 1882.1, 1893.1.

Carp culture

Reference should be made to "Pond culture" above wherein are cited many general treatises, relating primarily to carp culture.

General treatises. *Text in English.* Hessel, R. 1878.1, 1884.1; ★Nicklas, C. 1886.1; Logan, L. B. Add. 1888.1.

Text respectively in French and Italian. Le Play, A. 1889.1; Supino, F. 1911.1, 2.

Text in German. Knauthe, K. 1905.1; ★Knauthe, K., Apstein, C. & others. 1901.1; Leonhardt, E. E. 1906.8; ★Susta, J. 1888.1, 1905.1; Vogel, P. 1898.1; Walter, E. 1903.2-1906.1, 1909.2.

Miscellaneous papers on carp culture, chiefly minor items, notes, etc.

Text in English. Banditten, E. 1880.1, 1882.1; Barrington, D. 1772.1; Behr, S. 1883.2; Borne, M. 1883.3, 1885.3; Brakeley, J. H. 1884.1-1889.1; Cary, H. H. 1883.1; Davis, H. B. 1883.1; Donaldson, R. J. 1885.1; Eckardt, G. 1883.1; Eckardt, R. 1882.1, 2; Forster, J. R. 1772.1; Gasch, A. 1885.1; Gillespie, S. 1883.1; Himes, C. F. 1876.1; Hunger, O. 1883.1; Leary, J. L. 1904.1; Morriss, T. W. 1883.1; Nicklas, C. 1883.1, 1884.1, 2; Owen, R. 1860.1; Poppe, J. A. 1876.1; Rixford, G. C. 1880.1, 2, 1882.1; Scudder, C. W. 1884.1; Smiley, C. W. 1886.1; Smithers, E. J. 1885.1; Stabler, E. 1883.1; Stabrowski, X. 1887.1; Stover, E. S. 1884.1, 1885.1; Trybom, F. 1887.1; Van Antwerp, W. 1883.1; Yoakum, F. L. 1883.1; Yost, J. 1883.1; Gross, J. Add. 1886.1. — *Boxes for protection of eggs and young.* Wheeler, L. T. 1884.1.

Text in French. Burda, V. 1898.1; Künstler, J. 1910.1; Meugnot, A. 1908.1; Snickt, L. 1896.2.

Text in German, chiefly relating to carp culture in Germany. Berger, — 1875.1; Bruhns, E. 1877.2; Burda, V. 1898.2; Colb, — 1904.1; Cordes, F. 1871.1; Eben, — 1877.1; Gaertner, F. 1898.1; Giesecke, E. 1901.2; Hoffbauer, C. 1907.1; Jacobs, E. 1879.1; Leonhardt, E. E. 1905.3; Milker, — 1877.1; Müller, A. 1880.1; Reitter, E. 1880.1; Schiemenz, P. 1905.3; Schulze, T. 1911.1; Strüvy, R. 1876.1; Treskow-Weissagk, — 1878.1, 1883.1; Veckenstedt, E. 1877.1, 1880.1; Vogel, P. 1898.1; Wanke, — 1901.1; Anon. 69, 74, 213; Heyking, Add. 1911.1, 1912.1, 1913.1; Victorini, W. M. Add. 1775.1.

Catfish culture

Rearing catfish in ponds. Gardner, A. P. 1883.1; Jones, J. F. 1884.1; Jordan, D. S. 1884.5; ★Kendall, W. C. 1910.1; Leary, J. L. 1910.1.

Cod culture

First effort at artificial fertilization of cod, March, 1865, at Lofoten Is., Norway. Sars, G. O. 1865.1-1879.7.

First American hatchery established in 1878 at Gloucester, Mass. Earll, R. E. 1880.1.

Propagation of cod, 1880-87, at U. S. Fish Comm. Station at Woods Hole, Mass. Atkins, C. G. 1889.1; Bumpus, H. C. 1898.1-1898.4, 7, 1899.1, 2, 1900.1; Carswell, J. 1889.1; McDonald, M. 1884.2; Ryder, J. A. 1886.11; Anon. 468.

Methods employed by U. S. Bureau of Fisheries. Anon. 574.

Cod culture at marine hatchery of Flødevig near Arendal, Norway. Artificial hatching of naturally spawned eggs from fishes retained in ponds. Dahl, K. 1906.1, 2, 1907.1, 1909.2; Dannevig, G. M. 1887.1-1910.2; Rognerud, C. 1889.1. — *Apparatus and methods.* Dannevig, G. M. 1910.1. See also under Norway, below.

Cod culture at hatcheries of Dunbar and Bay of Nigg, Aberdeen, of Fishery Board for Scotland. Dannevig, H. C. 1896.1; Fulton, T. W. 1903.4.

Eel culture

References to the extensive cultivation of eels, by the rearing of young eels induced to enter areas later closed, as practised at Arcachon and especially the Lagoon of Comacchio, will be found below under "Marine fish farming" under France, and Italy.

Attempted introduction of eels into California. Smith, H. M. 1896.3; Stone, L. 1882.3.

Stocking inland waters of France with young eels. Soubeiran, J. L. 1865.1, 2.

Introduction of eels into the Danube. Haack, H. 1877.1, 1879.1, 5; Petsoldt, — 1880.1; Walter, E. 1910.1; Widdrington, S. E. 1841.1.

Stocking of streams and lakes or transplanting eels in Germany. Hermes, O. 1880.1; Lübbert, H. O. 1910.1, 1913.1; Schreiber, K. 1896.1; Stemmann, — 1878.2, 1879.1; ★Walter, E. 1910.2.

Flatfish culture

Plaice. *Hatching from naturally deposited spawn of confined fishes at Marine Hatchery, Bay of Nigg, Aberdeen, and Dunbar Marine Hatchery (now dismantled) of the Fishery Board for Scotland.* ★Dannevig, H. C. 1896.1-1901.1; Fulton, T. W. 1896.1, 2, 1903.4, 1909.1.

Plaice culture at hatchery at Piel-in-Barrow, England. Herdman, W. A. 1905.1.

Culture of Plaice at station of Haegadalen near Trondhjem, Norway. Nordgaard, O. 1909.1, 1914.1.

Plans for increasing supply in North Sea. Pettersson, O. & Schneider, G. 1908.1.

Pisciculture — Cont'd.

Sole. *Culture at Marine Laboratory at Concarneau, France.* ★Fabre-Domergue, P. & Biétreix, E. 1901.1–1905.1. — *Notice of this work.* Coupin, H. 1905.1.

Turbot. *Early experiments with turbot at St. Vaast-La-Hougue, France.* Coste, P. 1861.1.

Normal hatchings of turbot first obtained in 1898 at Marine Laboratory at Tatihou near St. Vaast-la-Hougue. Dantan, L. 1905.1; Malard, A. E. 1899.1.

Turbot successfully reared past resorption of umbilical sac. ★Anthony, R. 1907.2, 1908.1, 1910.1.

Grayling culture

Early attempts in U. S. at grayling culture. Clark, F. N. 1880.1; Collins, A. S. 1874.2; Roosevelt, R. B. & Green, S. 1879.1. — *Methods in grayling culture.* ★Henshall, J. A. 1898.1–1900.1, 1907.1. — *Hatching grayling at the N. Y. Aquarium.* Townsend, C. H. Add. 1913.4.

Aesche or *European grayling.* *Culture at Hüningen, Alsace.* Borne, M. 1878.4; Haack, H. 1878.2.

Herring culture

First artificial fertilization and hatching of herring. Meyer, H. A. 1879.1, 1880.1. — *Method of fertilization.* Ewart, J. C. 1884.3.

Mullet culture

Rearing mullet in fresh-water at St.-Valéry-sur-Somme, France. Blanchet, M. 1914.1.

Experiments in mullet culture at Port-de-Bouc, France, through rearing of fry induced to enter ponds later closed. Feddersen, A. F. 1869.1; Moquin-Tandon, G. & Soubeiran, J. L. 1865.1; Vidal, J. L. 1866.1–1871.1.

Similar pond culture of mullet in Hawaiian Is. Moser, J. F. in Rept. U. S. Fish Comm. XXIII, 1897 (1898), p. clxix.

Information on possibility of propagation of mullet in Florida. Ravenel, W. 1889.1.

Pike culture

Various papers on European culture of pike (Esox lucius). Nordqvist, O. F. 1911.2; Winkler, R. 1911.1; Michaelis, A. Add. 1910.1; Rütcke, — Add. 1911.1.

Pike-perch culture

Experiments and results of artificial fertilization of pike-perch in America. Downing, S. W. 1906.1, Add. 1911.1; Mather, F. 1891.3; Nevin, J. 1888.1, 1889.1; Reighard, J. E. 1891.1–1893.2; Stranahan, J. J. 1894.1.

Sander or *European pike-perch (Lucio-perca sandra).* *Methods of culture.* Horak, W. 1876.2; Raveret-Wattel, C. 1912.1; Ritter, B. 1906.1.

Culture in Finland. Huebner, A. 1898.1; Nordqvist, O. F. 1900.7, 1905.1, 1906.1; Sandman, J. A. 1899.1. — *in Germany.* Knauthe, K. 1891.7. — *in Sweden.* Lim-

borg, H. 1886.1, 1899.1; Lönnberg, A. J. 1899.8.

Salmon culture

Atlantic salmon. (*Salmo salar*) *propagated by U. S. Bureau of Fisheries on the Penobscot R., Maine, and at the Craig Brook hatchery and enclosures for ripening nearby at Dead Brook, Bucksport.*

Methods, history, etc. ★Atkins, C. G. 1872.2–1912.1, 1874.1, Add. 1884.1–1914.1, also his article in Anon. 574.

Landlocked salmon chiefly at Grand Lake Stream, Maine. Atkins, C. G. 1876.2–1885.3; Buck, W. O. 1910.1; Todd, F. 1882.1.

Pacific salmon. *First hatchery of U. S. Fish. Comm. established by L. Stone in 1872 on the McCloud R., tributary of Sacramento R., Cal., at a point later named Baird.*

History of this station, methods employed, etc. ★Stone, L. 1874.3–1889.2, 1897.1. — *Popular account.* Turner, W. M. 1875.1.

Methods employed in culture of Pacific salmon. General. Downing, S. W. 1901.1; Titcomb, J. W. 1910.1; Rutter, C. Add. 1904.1; Schofield, N. B. Add. 1898.2; Stone, L. in Anon. 574. *For extension of this, see* ★O'Malley, H. in Rept. U. S. Fish. Comm. 1919 (1921), Append. II, 32 p., Doc. 879. — *taking eggs by incision.* Bower, W. T. 1906.1. — *proper age at time of planting.* Gilbert, C. H. 1914.1. — *separating live and dead eggs by use of salt solution.* O'Malley, H. 1906.1. — *rearing and feeding fry.* Shebley, W. H. 1915.1. — *burial of eggs.* Babcock, J. P. Add. 1911.1.

Afognak I., Alaska, or similar locality proposed as a national salmon park. Stone, L. 1893.1; Bean, T. H. 1892.9.

European salmon. *General treatises on salmon culture, text in English.* Ashworth, E. & Ashworth, T. 1853.1; Ashworth, T. 1866.1; Fitzgibbon, E. & Young, A. 1850.1; Ramsbottom, R. C. 1854.1.

Gen. treat., text in French. Raveret-Wattel, C. 1904.1.

Various papers on methods, etc. Andrews, T. 1883.1; Bergasse, — 1852.1; Caustier, E. 1907.1; Hogg, J. 1838.1, 1854.1; La Blanchère, P. 1869.3; Mackenzie, F. A. 1842.1; Mir, E. 1908.1.

For culture in various countries, see below under British Isles, Denmark, Finland, France, Germany, Norway, Spain, Sweden and Switzerland.

Shad culture

American shad. (*Clupea sapidissima*.) *First shad hatched by Seth Green at South Hadley Falls, Mass., 1867.* Clift, (Rev.) W. 1873.1; Green, S. 1880.3; Peirce, M. P. 1880.2, 3, 4.

Methods in culture as practised by U. S. Bureau of Fisheries, chiefly upon its steamers, "Fish Hawk," "Halcyon," and "Lookout." Baird, S. F. 1874.27; Griswold, C. D. 1876.1; Hamlen, W. 1889.1; Mather, F. 1876.1, 8; Milner, J. W. 1874.4–1880.4; Smith, J. A. 1885.1–

1889.5; Wood, W. M. 1884.3,6; Anon. 574. — *Effect of sunlight upon eggs*. Page, W. F. 1885.1. — *Experiments upon retarding development of shad*. Rice, H. J. 1884.1; Ryder, J. A. 1882.8. — *Possible expansion of hatchery work*. Worth, S. G. 1910.1.

Shad hatching in various localities. — *Florida rivers*. Cary, H. H. 1885.1; Hamlen, W. 1884.1. — *in South Carolina*. Huske, C. J. 1883.1, 1884.2. — *N. Y., Cold Spring Harbor*. McDonald, M. 1884.10. — *Alabama, Coosa R.* Smiley, C. W. 1883.12. — *Maine. Results of planting shad in Kennebec R.* Smith, E. 1889.1; Stilwell, E. M. 1874.2. — *Operations at the navy yard station, Washington, D. C.* Wood, W. M. 1884.5. — *Albemarle Sound*. Worth, S. G. 1883.2. — *Operations at Havre-de-Grace, see below under Pisciculture, Maryland*.

Maifish. (*Clupea alosa*) *Culture in France*. Vincent, P. 1890.1.

Culture in Germany. Behr, S. 1879.2; Eckardt, R. 1878.1, 1879.4; Hoek, P. 1895.2, 1897.3, 1899.1.

Smelt culture

Smelt successfully hatched from naturally deposited eggs by the New York Fish. Comm. at Cold Spring Harbor. Mather, F. 1886.4, 1887.4, 1895.1. — *Experiments of C. G. Atkins*. Baird, S. F. 1875.25.

Spanish Mackerel culture

Various papers on culture of Spanish mackerel in U. S. Earll, R. E. 1883.2, 1884.1; McDonald, M. 1884.11; Smiley, C. W. 1881.1; Verrill, A. E. 1880.1; Wood, W. M. 1885.1. — *Apparatus for hatching Spanish mackerel*. Kite, J. A. Add. 1885.1. — *Utility and methods of propagation*. Moore, J. P. Add. 1898.1.

Striped Bass culture

Propagated chiefly at Weldon and vicinity of Albemarle Sound, North Carolina. For details see Worth, S. G. 1882.1, 1885.1,2, 1905.1, 1910.1, Add. 1884.2, 1903.1. — *First propagation of striped bass by M. G. Holton, at Weldon, N. C.* Milner, J. W. 1874.4. — *Various items*. Akers, G. F. 1879.1; Blackford, E. G. 1879.3; Green, S. 1883.1; Norny, E. R. 1882.1,2, Add. 1885.1; Burns, F. Add. 1887.1.

For successful acclimatization in California, see Introduction, above.

Sturgeon culture

In this country, in spite of the increasing scarcity, sturgeon propagation is still in the experimental stage. In addition to the initial difficulty in securing ripe fishes of both sexes at the same time, which necessitates impounding with subsequent frequent infertility of eggs, the adhesive nature of the eggs is an additional obstacle. They have usually been hatched in floating boxes and have been frequently subject to fungus attacks. Further difficulties have been met with in the tendency of the female to "throw" or violently expel all her eggs immediately when drawn from the water. This difficulty has been partially met by the insertion of a plug in the genital pore. Attempts at rearing the young have been unsuccessful, owing to the failure of the young to eat.

In Russia, however, on some of the rivers flowing into the Caspian Sea such as the Ural and Volga, efforts have been more successful and numbers of young have been produced. It seems that sturgeon eggs become ripe only when both male and female are kept together in the same enclosure. The naturally muddy river water was used to overcome the adhesiveness of the eggs. Details of this Russian work are given below and in a brief note by N. A. Borodin in the Rept. U. S. Comm. Fish., 1919, Appendix III, pp. 6-7.

First hatching in America of sturgeon by Seth Green in 1875 at New Hamburg, N. Y. Baird, S. F. 1875.34; Roosevelt, R. B. & Green, S. 1879.1.

Experiments on Delaware R. at Delaware City, Del. Dean, B. 1893.6; Ryder, J. A. 1890.4. — *Impounding sturgeon on Delaware R. at Bristol, Pa.* Meehan, W. E. 1910.1.

Experiments in Lake Champlain basin in Vermont. Carter, E. N. 1905.1; ★Stone, L. 1902.1. — *on Hudson R.* Green, S. 1883.1. — *on St. Clair R., Michigan*. Post, H. 1891.1.

German experiments in sturgeon culture on Elbe R. Frauen, M. 1878.1; Müller, T. 1879.1; Quantz, H. 1903.1; Jacobson, H. Add. 1891.1.

Russian methods. *Culture on Ural R.* Borodin, N. A. 1885.1.

Earliest Russian experiments in artificial fertilization of sturgeon. Kovalevskii, Ovsjannikov & Wagner. 1870.1; Knoch, J. 1871.1. — *Comment on Knoch*. Borne, M. 1878.6.

Various papers with text in Russian on successful sturgeon culture. Borodin, N. A. 1902.1; Desnickij, V. M. 1912.1; Kuchin, I. B. 1910.1; Meissner, V. I. 1908.1; Tichenko, S. 1907.1. — *Food and development of young*. Ergomysev, N. Add. 1914.1. — *Rearing of fry*. Peltzam, E. D. Add. 1876.1.

Trout culture

General treatises. *Text in English*. Capel, C. C. 1877.1; Custance, F. H. 1898.1; Green, S. & Collins, A. S. 1870.1; Slack, J. H. 1872.1; ★Stone, L. 1872.3.

Text in French. ★Blanchon, H. 1911.2; Diessner, B. 1902.1.

Text in German. Mayer, J. 1876.1; ★Vogel, P. 1898.1; Walter, E. 1906.1.

Text in Italian. Stone, L. 1884.5.

Methods in trout culture. Arens, C. 1906.1; Bower, S. 1896.1; Butler, W. 1900.1; Cheney, A. N. 1898.3, 1900.2; Collins, A. S. 1870.1, 1873.1, 1874.2, 1876.1; Cummings, H. 1882.1; Dykeman, J. R. 1874.1; Fullerton, S. F. 1912.1; Gardner, A. P. 1883.1; Gilbert, W. L. 1894.1; ★Hein, W. 1906.1, 1907.1; Koss, R. A. 1883.1; Léger, L. 1913.1; Lemmermann, E. 1897.1; Mather, F. 1872.1, 1874.1, 1875.2; Porter, B. B. 1878.4; ★Seagle, G. A. 1896.1, 1903.1; Seal, W. P. 1893.1; Stirling, J. 1883.1; Stone, L. 1872.2, 1879.6, 1885.6; Sykes, A. 1903.1; Thompson, W. T. 1912.1; Langguth, T. G. Add. 1913.1. — *Prospective returns for surface area in trout ponds*. Raveret-

Pisciculture — Cont'd.

Wattel, C. 1915.1. — *Collection and use of wild spawn.* Titcomb, J. W. 1898.1. — *Sanitary hatching apparatus.* Vincent, E. 1910.1.

Earliest paper on artificial fertilization of trout. Jacobi, S. L. 1765.1.

Proper food for trout and methods of feeding. Allen, G. R. 1906.1; Baird, S. F. 1871.17, 1875.11; Clapham, T. 1880.1; Forbes, H. O. 1897.1; Green, S. 1876.1, .4, .7; Haemmerle, O. 1876.1; Lampert, K. 1900.1; Land, S. E. 1898.1; Nicklas, C. 1884.2; Overbeck, G. 1880.1; ★Page, W. F. 1895.1; Paige, C. L. 1910.1, .2; Revoil, C. 1892.1; Seemann, — 1861.1; Steuert, L. 1901.1; Thompson, W. T. 1901.1; Weeger, E. 1900.1; Harz, C. O. Add. 1884.1. — *Molluscs.* Blanchet, M. 1912.1. — *Tadpoles.* Eckstein, K. 1901.1. — *Tubifex.* Fehlmann, J. W. 1912.2; Simms, G. E. 1912.1. — *Fresh-water shrimp, Gammarus.* Mather, F. 1897.1, .2. — *Automatic arrangement for feeding.* Rueff, A. 1876.1. — *Fish meal as food.* Embury, G. C. Add. 1914.1.

Stocking trout streams; proper means with selection of fry or fingerlings, etc. Brackett, E. A. 1893.1; ★Evermann, B. W. 1905.13; Green, S. 1876.7, 1880.5; Holberton, W. 1883.1; Maitland, J. 1892.1; Mather, F. 1893.1; Prince, E. E. 1901.2; Van Cleef, J. S. 1886.1, 1896.1; Wozelka-Iglau, K. 1891.1; Cheney, A. N. Add. 1897.1; Meehen, W. E. Add. 1905.1.

For trout culture in various countries, see below under Austria, Bohemia; British Isles; Denmark; Finland; France; Germany; and Switzerland.

Whitefish culture

American whitefish (Coregonus clupeiformis), artificially fertilized and hatched by U. S. Fish Comm., chiefly on the Great Lakes, Detroit R., and at Northville, Michigan. Baird, S. F. 1876.11; Bissell, J. H. 1893.1; Bower, S. 1884.1, 1896.1; ★Clark, F. N. 1881.1–1908.2; Curtis, J. E. 1884.1; Downing, S. W. 1905.1, 1908.1; Gauthier, C. W. 1911.1; Green, C. K. 1899.1; Green, S. 1875.7; Metcalf, M. 1887.1; Parker, J. C. 1889.1; Reighard, P. 1910.1; Sterling, E. 1876.1, 1877.3; Stone, L. 1872.6; Wilmot, S. 1875.1; Anon. 574; Stranahan, J. J. Add. 1898.1. — *Food of young fish.* Forbes, S. A. 1882.2, .3; Townsend, C. H. 1906.3.

European whitefish. (Maræne). *Chiefly in Germany and adjacent waters.* ★Borne, M. 1878.3, 1879.3; Crettiez, J. 1906.2; Lesseux, C. 1903.1; Serlachius, G. A. 1898.1; Stentzel, A. 1876.1; Wengen, — 1871.7.

"Nordseeschnäpel" (Coregonus oxyrhynchus). Surbeck, G. 1903.2.

"Grosse or Peipus Maræne" from Baltic provinces, in Germany. Eckhardt, R. 1875.1, 1877.1, 1878.2, .3; Dröschner, W. 1901.1; Surbeck, G. 1905.4, 1907.1; Zur Mühlen, M. 1911.27.

"Blaufelchen" (C. macrophthalmus), in Switzerland and Germany. Haack, H. 1878.2–1882.3; Heuscher, J. 1906.2; Nüsslin, O. 1907.4; Schweizer, W. 1913.1; Anon. 92.

Yellow Perch culture

Various notes on rearing in ponds, treatment of eggs in hatching, etc. Buller, N. R. 1906.1; Gorham, W. B. 1912.1; Robinson, G. 1878.1; Worth, S. G. 1892.1.

Various fishes cultivated

Crappies and sunfish. Bartlett, S. P. 1883.1; Leary, J. L. 1910.1, Add. 1911.1; Stranahan, J. J. 1912.1.

Gold and red orfe. Kirsch, D. W. 1872.1–1876.1, 1883.1.

Gudgeon in France. Roule, L. 1906.2.

Tench culture in European countries. Nordqvist, O. F. 1895.6; Owen, R. 1860.1; Stropahl, E. 1906.1; Walter, E. 1906.1; Trybom, F. 1887.3.

Pisciculture by Countries

References throughout this section to the introduction or acclimatization of various fishes refer to the special section above.

AFRICA

Algeria. *Milianah, experiments at.* Liebert, F. 1864.1, .2. — *Carp introduced.* Cosson, E. S. 1862.1.

Madagascar. *Carp introduced.* Dagry, A. Add. 1914.1.

Natal. *European trout introduced.* Feilden, H. W. Add. 1893.1.

ASIA

Ceylon. Willey, A. Add. 1909.1. — *Gourami introduced, see above.*

China. Baird, S. F. 1875.8; Borne, M. 1888.1; Courcy, 1866.1; ★Dabry de Thiersant, P. 1863.1 (*Gen. treat.*), 1872.1; Figuier, G. L. 1858.1; Kopsch, H. 1875.1, 1876.1; Leonhardt, E. E. 1902.1, 1904.7, .17; McGowan, D. J. 1885.1 (*Carp culture*); Renard, E. 1875.1, .2; Salter, G. H. 1874.1, 1876.1 (*Yang-Tse-Kiang*); Schlegel, G. 1863.1; Seymour, C. 1885.1; Shephard, I. F. 1885.1; Smart, J., Goldsmith, — & Johnson, — 1884.1; Smithers, E. J. 1885.1 (*Carp*); Doolittle, J. Add. 1865.1.

India. *Pisciculture on the Neilgherry hills.* Day, F. 1868.7; Soubeiran, J. L. 1870.3. — *Marine fish farming proposed.* Hornell, J. Add. 1912.1. — *trout introduced, see above.*

Japan. Matsubara, A. & Lebedincev, A. 1902.1; ★Mitsukuri, K. 1905.1; Raveret-Wattel, C. 1885.3, 1911.2, Add. 1911.1; Renard, E. 1875.1, .2. — *Trout.* Aekio, S. 1882.1. — *Goldfish.* Matsubara, S. 1906.1, 1908.1; Smith, H. M. 1909.2. — *Carp, gourami, and rainbow trout introduced, see above.*

Malay Peninsula. *Malacca.* Wray, L. 1885.1.

EUROPE

Austria-Hungary

General treatises. Daday, J. 1897.1; Trinks, Z. 1908.1; Vogel, P. 1909.1.

Miscellaneous papers. Brusina, S. 1888.1; Fitzinger, L. J. 1875.1; Köttl, J. 1880.1; Kriesch, J. 1869.1; Landgraf, J. 1897.1; Lindes, L. 1880.14; Ortway, T. 1899.1; Wispauer, J. 1880.2; Haack, H. Add. 1881.1. — *Carp.* Gasch, A. 1885.1, 1906.1. — *Pike.* Horak, W. 1876.2; Winkler, R. 1911.1. — *Black bass and salmon introduced, see above.*

Various localities. Salzburg, desc. Central Institute of Pisciculture. Bouchon-Brandely, G. J. 1874.1. — *Canale della Montagna.* Budden, R. H. 1883.1. — *Vienna reports of work in Institute für Fischkrankheiten.* Fiebiger, J. 1908.1, 1909.2, 1910.1. — *Einsiedel.* Gampe, 1874.1. — *Tyrol.* Giglioli, E. H. 1902.1; Mayr, J. 1880.1. — *Activities of the Frauenberg Pond Culture Experiment Station.* Haempel, O. 1908.1; Kammerer, P. 1907.6,9. — *Carniola.* Trout culture. Kasteliz, R. 1880.2. — *Freiland.* Marenzeller, E. 1878.1. — *Görz and Gradiska.* Pauletic, — 1875.1. — *Gmünden; establishment of Franz Fischill.* Zangerl, J. 1880.1. — *In the upper Danube (historical).* Naegele, A. Add. 1913.1.

Bohemia. Kisz-Selmecz. Revay, S. 1878.1. — *Szomalány.* Rowland, W. 1880.1. — *Trout culture.* De Kay, C. 1895.1; Fritsch, A. J. 1874.1, 1879.1; Raveret-Wattel, C. 1896.1; Smith, H. M. 1907.3; Wengen, — 1876.1.

Most extensive pond-cultural establishment in world of Prince Schwarzenberg at Wittingau, description, historical, etc. Horak, W. 1869.1; Nicklas, C. 1878.1, 1886.1; Susta, J. Add. 1898.1.

Galicia. Nowicki, M. 1879.1–1880.2, (salmon) 1880.3. — *Pond culture on the estate of Archduke Albrecht, in Biala.* Gasch, A. 1883.1.

Belgium

General treatise. Weigelt, C. 1903.1. — *Other papers.* Gens, E. 1891.1; Longchamps, S. 1884.1. — *Fish ladders in Meuse and Ourthe Rivers.* Denil, G. 1909.1. — *Gileppe Lake.* Huberty, J. 1896.1. — *Brussels Botanical Gardens, experiments.* Jagor, A. F. 1865.1; Schram, A. 1864.1. — *Catfish introduction proposed, see above.*

Luxembourg. Raveret-Wattel, C. 1883.1.

British Isles

England. Miscellaneous papers. Brett, A. T. 1878.1; Brougham, W. H. 1877.1, 1878.1; Cecil, W. A. 1885.1; Friedel, E. 1871.1; Hood, P. 1878.1; Vouga, P. 1872.1; Manley, J. J. Add. 1884.1. — *Herefordshire.* Lloyd, J. & Symonds, — 1868.1.

Salmon and trout culture. Brotherson, A. 1882.1; Buckland, F. T. 1864.1–1872.1; Butler, A. G. 1879.1; Chambers, W. O. 1883.3; Jardine, W. 1856.1; Waite, E. R.

1892.1; Webb, W. F. 1870.1; Armistead, J. J. Add. 1895.1. — *Attempts at restoring salmon in Thames R.* Boulton, W. B. 1904.1; Brougham, W. H. 1878.2; Carington, J. T. 1876.1. — *Planting Tees R. salmon in Swale R., Yorkshire.* Hogg, J. Add. 1855.1.

For work of hatching station of Lancashire Sea Fisheries Committee, at Piel-in-Barrow, see Stations and Laboratories, under Fisheries.

Black bass, catfish, salmon, trout, and whitefish introduced, see above.

Early treatises on fish-culture, references in Pre-Linn. section. Bradley, R. 1721.1; Moore, J. 1703.1; Mortimer, J. 1707.1; North, R. 1713.1. — *Pioneer fish culturist.* Mascall, L. 1500.1.

Ireland. Fennell, J. 1849.1. — *Rock-mills hatchery; report 1907–1908.* Hillas, A. B. 1909.1. — *Lismore; salmon hatchery; report.* Oliver, C. D. 1902.1.

Scotland. Bickerdyke, J. 1893.1. — *Salmon hatcheries.* Calderwood, W. L. 1901.2. — *Fish-farming.* Spreckley, H. 1903.1.

Salmon breeding establishment at Stormontfield-on-Tay, near Perth; activities. Ashworth, E. 1875.1; Ashworth, E., Jardine, W. & Fleming, — 1856.1; Brown, W. 1862.1; Buist, R. 1856.1, 1866.1; Duncan, J. B. 1885.1; Fleming, J. 1856.1; Tegetmeier, R. B. 1868.1.

Salmon operations at Howietoun hatchery, at Stirling. Day, F. 1885.10, 1887.3; Maitland, J. R. G. Add. 1887.1.

Stocking Loch Ard with Loch Leven trout. Hamilton, E. 1887.1; Lankester, E., Day, F. & Hamilton, E. Add. 1887.1.

For hatching operations at Dunbar Marine Hatchery, and at station at Bay of Nigg, Aberdeen, see Fishery Board for Scotland, under Fisheries, Scotland.

Carp and salmon introduced, see above.

Wales. Roath Park hatchery. Pettigrew, W. W. 1905.1.

Denmark

Bodahl, E. A. 1908.1; Hansen, A. M. 1866.1; Haack, H. Add. 1881.1. — *Salmon.* Feddersen, A. F. 1870.1. — *Odense Society; activities.* Osterby, R. 1870.1. — *Limfjord; small plaice brought in from North Sea.* Petersen, C. G. 1897.1, 1899.1, 1901.3, 1903.1, 1909.1,3, 1911.1. — *Eel fry for planting.* Petersen, C. G. Add. 1892.1. — *Trout.* Raveret-Wattel, C. 1906.1.

France

For initial efforts in fish-culture in France, see Historical matters, above.

General treatises. ★Bouchon-Brandely, G. 1876.1; Brocchi, P. 1896.1; Bruyant, C. & Eusebio, J. 1904.1; Gauckler, P. 1879.1, 1880.1; Millet, C. 1870.1; Pizzetta, J. 1878.1, 1880.1; ★Raveret-Wattel, C. 1904.1; Rimbaud, J. B. 1869.1.

Miscellaneous papers. Anjubault, P. A. 1855.1; Bello y Espinosa, D. 1896.1; Béraud, T. C. 1858.1; Blackwell, A.

Pisciculture — Cont'd.

1861.1; Caillaud, R. 1858.1, 1860.1, 1864.1; Chaîne, J. 1901.2, 1903.1; Chauvin, F. 1858.1; Cloquet, J. G. 1858.1; Confeyron, — 1894.1; Figuiet, G. L. 1858.1 (iii); Forcade la Roquette, — 1860.1; Jameson, A. C. 1867.1; Joly, N. 1866.1; Kleinert, — 1861.1; Pelletan, J. 1869.1; Pouchet, G. 1872.4; Rivière, — 1866.1; Rougon, J. C. 1861.1; Ruau, — 1904.1; Vibraye, P. 1854.1, 1855.1, 1858.1; Wallon, E. 1864.1–1868.1. — *Congress of societies of pisciculture.* Künstler, J. 1897.1.

Suggested means of repopulating French streams. Coste, J. J. 1857.1; Coste, P. 1853.1; Duméril, A. H. 1863.1, 1866.1; Goll, H. 1892.1; Hubault, P. 1907.1; Mayre, — 1874.1–1876.1; Roule, L. & Caradaillac de S.-P., G. 1902.1, 1903.2, 1905.1; Saint-Paul, G. D. 1906.1; Volmerange, — 1905.1.

Marine fish farming; chiefly through transformation of salt marshes into ponds with tidal circulation by sluices, and rearing in them of immigrant young fishes, chiefly mullet, eels and sea-basses.

General discussions as to methods, etc., with especial reference to salt-water ponds of the Basin of Arcachon. Chauvin, F. M. 1858.1; Coste, P. 1862.1; ★Ducastel, M. 1879.1, 2; ★Gobin, A. 1891.1; Maude, A. 1858.1; Millet, C. 1856.1; Schmarda, L. K. 1869.1; Varigny, H. C. 1906.1; ★Hornell, J. Add. 1912.1; Roché, G. Add. 1898.1.

Mediterranean ponds, especially establishment of M. Vidal at Port-de-Bouc, near Marseilles. ★Bouchon-Brandely, G. J. 1878.1, 1880.1; Feddersen, A. F. 1869.1; Lamiral, E. 1864.1; Moquin-Tandon, G. & Soubeiran, J. L. 1865.1; Vidal, J. L. 1866.1, 1867.1; Wallut, C. 1863.1.

Piscicultural activities in various localities. *Yonne (Dept.)* Bert, P. 1871.1. — *Biarritz, establishment of M. Sithouette.* Bertrand, M. 1873.1. — *Manche (Dept.)* Besnou, L. 1861.1; Sivard de Beaulieu, G. 1854.1. — *Somme (Dept.)* Blanchet, M. 1914.1; Carpentier, E. 1911.1; Dubois, M. 1891.1, 1895.1; Lefebvre, A. 1887.1, 1893.1. — *Laboratories at Quillan and Gesse (Aude).* Bouffet, — 1889.1, Add. 1894.1. — *Paris.* Bouvaist, — 1889.1. *In catacombs.* Guerne, J. 1897.2. — *Ain (Dept.)* Broca, P. P. 1890.1. *Establishment at Gremaz.* Raveret-Wattel, C. 1882.1, 1887.1, 1889.3, 1893.3. — *Val-Saint-Germaine; visit to.* Bruyère, H. 1910.1. — *Aisne R.* Caron, C. 1865.1. — *Vosges.* Chevreuse, A. 1867.1; Chevreuse, E. 1868.1. — *Haute Loire, Lac Saint-Front.* De Causans, — 1885.1; Comarmoud, Add. 1853.1. — *Meurthe-et-Moselle (Dept.)* Delaval, A. 1899.1; Drouin de Bouville, R. 1901.1. — *Marne.* Delouche, — 1870.1. — *Bouches-du-Rhone.* Derbès, A. 1856.1. — *Eure.* D'Hallo, L. 1885.1; Raveret-Wattel, C. 1895.5. — *Hérault.* Figuiet, G. L. 1858.1 (v); Gavini, — 1860.1; Gervais, F. L. 1861.1, 1862.1, 2, 1864.2–1866.1. — *Retournemer, activities at.*

Gail, — 1907.1. — *University of Grenoble.* *Piscicultural activities.* Galbert, A. 1893.1, 1896.1, 1902.1; Léger, L. 1904.2, 1905.5, 1907.2, 1909.2, 3, 4, 1910.1, 1913.2; Perrier, L. 1909.1, Add. 1914.1. — *Deux-Sèvres.* Gelin, H. 1911.1. — *Establishment founded by M. Devey, at Belfaud.* Gremaud, A. 1881.1. — *Normandy.* Haack, H. 1872.2; Moucheron, — 1897.1. — *Limoges.* Joly de Saily, — 1901.3. — *Cadillac-sur-Garonne.* La Blanchère, P. 1868.1. — *Results of experiments at Maintenon (Eure-et-Loir).* Lamy, I. 1866.1; Rabot, — 1861.1. — *Puy-de-Dôme.* Lecoq, H. 1861.1; Rico, B. 1869.1, Add. 1876.1; Rougane de Chanteloup, — 1875.1. — *Haute-Savoie, Faucigny.* Morel-Fredel, — 1899.1. — *Seine-Inférieure.* Péron, A. 1858.1; Raveret-Wattel, C. 1893.4, 1894.1. — *Dauphiné.* (Pond culture.) Pion-Gaud, P. 1904.1; Pion-Gaud, P. & Lavauden, L. 1904.1. — *Côte-d'Or.* Ramelet, J. 1896.1. *Dijon.* Laval, J. 1854.1. — *Pas-de-Calais.* Raveret-Wattel, C. 1880.3; Cligny, A. Add. 1907.2. — *Piscicultural activities of the University of Toulouse.* Roule, L. 1904.3, 4; Roule, L. & Audigé, J. 1905.1; Zacharias, E. O. 1905.4; — *Toulon.* Turrel, L. 1878.1. *Lozère (Dept.); early activities.* Valantin, — 1855.1. — *Avilliers; establishment of M. de Selve.* Wallut, C. 1867.1. — *Oise.* Zoéga, F. L. 1859.1.

Various fishes cultivated. *Black bass, catfish, gourami, salmon, trout and whitefish introduced, see above.*

Allis shad culture. Vincent, P. 1890.1.

Cultivation of turbot at marine laboratory near Saint-Vaast-La-Hougue. Anthony, R. 1907.1–1910.1; Malard, A. E. 1899.1.

Salmon and trout culture. Caumont, A. 1850.1; Caustier, E. 1907.1; Crettiez, J. 1906.1; Denys, R. 1894.1; Drouin de Bouville, R. 1908.3; Gillet de Grandmont, A. 1863.1, 2, 3; Hesse, E. 1908.1; Jousset de Bellesme, G. 1901.1; Lefebvre, A. 1896.1, Add. 1886.1; Léger, L. 1905.3, 1910.3; Marchand, E. 1899.1; Perrier, L. & Guyon, J. 1906.1; Raveret-Wattel, C. 1885.3; Rico, B. 1874.1; Künstler, J. Add. 1889.1, 1893.1, 1893.2.

Germany

General treatises. Biermann, A. 1865.1; Reider, J. E. 1825.1; Skowronnek, F. 1904.1. — *Early treatise.* Staentzl, A. L. Pre-Linn. 1680.1.

Miscellaneous papers. Arens, C. 1896.1; Behr, S. 1877.1, 1879.3; Byström, C. 1864.1; Delius, A. 1874.1; Leonhardt, E. E. 1905.7; Möbius, K. A. 1871.1; Müller, — 1879.1; Schiemenz, P. 1904.1; Sichter, W. 1906.1; Walter, E. 1909.1; Wirth, F. 1871.1; Gleditsch, J. G. Add. 1765.1; Haempel, O. Add. 1914.1; Krünitz, J. G. Add. 1773.1.

Fish-cultural establishments. Bettoni, E. & Vinciguerra, D. 1889.1; Lönnberg, A. J. 1892.1. — *Floating station of upper Rhine.* Lauterborn, R. 1900.1. — *List of establishments, 1873.* Wengen, — 1875.2.

Hünigen station in Alsace near Baden, established by French Gov't in 1850, first public establishment. — *Activities, etc.* Bulach, H. 1878.1; Haack, H. 1871.3, 1872.1, 1875.1, 1878.2, 5, 1904.1; Pouchet, G. 1856.1; Séré, E. 1868.1; Winckler, T. 1874.1; Anon. 624. — *Historical notes on Hünigen.* Coste, J. J. 1850.1; Coumes, — 1862.1; Detzem, — & Berthelot, S. 1851.1.

Piscicultural activities in various localities. — *Mecklenburg-Schwerin.* Altenburg, — 1868.1 (Boitzenburg); Brüssow, — 1877.1. — *Saxony (Kingdom).* Becker, H. 1901.1; Rohr, J. B. Add. 1772.1. — *Shaalsee, need for establishment.* Dröschner, W. 1908.1. — *Weser R.* Hapke, L. 1876.1–1913.1. — *Fischzuchtverein of Ohrdruf, Saxe-Coburg-Gotha.* Lindeman, M. 1878.1. — *Thuringia.* Rötteken, F. 1878.1. — *Württemberg.* Rueff, A. 1872.1. — *Hesse.* Schultze, J. 1914.1. — *Main R.* Surbeck, G. 1904.3.

Baden. Buchenberger, A. 1888.1, 1903.1; Haldenwang, A. 1879.1, 1880.1; Rottra, F. 1877.1; Wengen, — 1871.5 (Freiburg); Anon. 82.

Bavaria. Heckenstaller, — 1879.1, 2, 1880.1; Heuscher, J. & Hersche, — 1902.1; Anon. 71. — *Landwirthschaftlichen-Verein, activities.* Fraas, C. N. 1854.1. — *Mühlthal; activities, 1907–1908.* Hein, W. 1908.3. — *Kuffer's station at Munich.* Kuffer, J. B. 1861.1; Oppermann, — 1867.1. — *Simbach.* Anon. 61.

Prussia. Dumreicher, A. 1868.1; Löns, H. 1908.1; Nadmorski, — 1882.1; Seelig, F. W. 1897.2; Seelig, G. 1877.1. — *Engelstein.* Ackerhof, A. D. 1880.1. — *Feldberg, Taunus.* Baumbach, F. 1880.1. — *Gremsmühlen at Eutin.* Bruhns, E. 1877.1, 1878.1; Simmermacher, G. 1883.2. — *Hülsberg at Lüttringhausen.* Chevalier, P. 1879.1. — *Lakwitz near Berlin.* Cremer, J. 1897.1. — *Schleswig-Holstein.* Dallmer, E. 1878.2. — *Sandfort, near Osnabrück, Hannover Prov.* Jaffé, S. 1895.1–1896.3; Raveret-Wattel, C. 1897.1. — *Danzig; activities 1873–1874.* Liebeneiner, — 1875.1. — *Rhine Provinces.* Pollen, F. P. 1870.1, 1871.5. — *Brunswick, Michaelstein.* Raveret-Wattel, C. 1895.3. — *Silesia.* Schikora, F. 1903.1; Stentzel, A. 1879.1. *Trachenberg, activities.* Hoffbauer, C. 1899.1, 1901.2, 1903.1, 1912.1. — *Schleusingen.* Schmidt, — 1869.1. — *Pomerania.* Blankenburg, — 1879.1; Bodin, T. 1879.1. — *Carp ponds of Niederlausitz. (Nether Lusatia).* Veckenstedt, E. 1877.1, 1880.1.

Salmon and trout culture. Ahlers, C. 1900.1; Arbenz, E. 1896.1; Becker, H. 1901.1; Bettoni, E. & Vinciguerra, D. 1889.1; Bieler, G. A. 1880.1; Boiteux, L. 1911.1; Borne, M. 1877.1, 1878.4; Capelle, H. 1908.1; Cligny, A. 1906.3; Dallmer, E. 1878.6, 1879.1; Giesecke, E. 1901.1; Grimm, O., Henking, H., Levinson, C. & Trybom, F. 1905.1; Haack, H. 1871.2, 1879.4, 1880.2, 3, 5, 1882.2, 3; Heckenstaller, — 1879.1, 2; ★Hoek, P. P.

1910.2; Jaffé, S. 1895.1–1896.3, 1897.1; Knauth, K. 1896.5; Küchenmeister, G. F. 1861.1; Kunkel, — 1884.1; Laer, W. 1863.1; Metzger, A. 1878.1, 1879.2; Rhein, — 1867.1; Riedel, — 1873.1; Stadelmann, — 1867.1; Stephan, — & Kuffer, J. B. 1877.1; Steuert, L. 1898.1, 1901.2; Stone, L. 1873.1; Trybom, F. 1910.1; Weigelt, C. 1896.2; Wengen, — 1877.1, 1878.1, 1879.1, 1880.1.

Black bass, carp, catfish, salmon, shad, trout, and whitefish introduced, see above.

Iceland

First hatcheries established at Reynivellir and Thingvellir for salmon and trout, respectively. Thorarinsson, B. S. 1889.1.

Italy

Black bass, carp, catfish, gourami, salmon, sunfish, trout, and whitefish introduced, see above.

Definite localities. *Lake Maggiore.* Andrea, M. 1901.1. — *Verona.* Betta, F. E. 1861.1, 1862.1. — *Ticino.* Calloni, S. 1886.1. — *Naples.* Costa, A. 1864.1. — *Bergamo.* Gervasoni, T. 1899.1. — *Lake Trasimano.* Misuri, A. 1915.1. — *Lake Ossolani and Lake Valdostani.* Monti, R. 1903.1. — *Cuneo.* Remondino, C. 1915.1. — *Sicily.* Vinciguerra, D. 1896.1. — *Brescia station.* Bettoni, E. Add. 1886.1. — *Torbole station.* Canestrini, A. Add. 1914.1. — *Torre di Zuino (Friuli).* Levi-Morenos, D. Add. 1903.1, 2.

Marine fish farming of Lagoon of Comacchio. *Accounts of the extensive fisheries, chiefly eel, but also including mullet and smelts.* Bellini, A. 1899.1–1911.1; Bettziech, J. 1869.1; Bullo, G. S. 1891.1; ★Coste, J. J. 1855.1, 1866.2; Friedländer, E. 1872.1; Gobin, A. 1891.1; ★Henking, H. 1908.1; Jacoby, L. 1880.1; Montanus, E. 1911.1; Proli, P. P. 1761.1; Raveret-Wattel, C. 1907.1; Schiemenz, P. 1908.1; Spallanzani, L. 1797.1; ★Hornell, J. Add. 1912.1.

Marine fish culture in vicinity of Venice. Moretti, S. 1887.1; Nardo, G. D. 1864.1, 1873.1; Ninni, A. 1887.1.

Marine fish ponds of the ancient Romans, refs. in Pre-Linn. section. Agrippa, H. C. 1569.1; Columella, L. J. 1472.1; Salengre, H. 1724.1; ★Varro, M. T. 1472.1.

Miscellaneous papers. Besana, G. 1897.1–1908.2; Bettoni, E. 1894.2; Bettoni, G. 1899.1; Filippi, F. 1853.1; Levi-Morenos, D. 1895.1, 1912.1; Mazzarelli, G. F. 1903.1, 1905.1; Meschinelli, L. 1897.1; Molin, R. 1860.3; Orsenigo, L. 1912.1; Plehn, M. 1908.1; Solla, R. 1895.1; Supino, F. 1909.3 (carp), 1910.3; Anon. 123; Costantini, L. Add. 1903.1; Vincenzo di Eugenio, V. Add. 1903.1. — *Early ref.* Abbondio, G. Pre-Linn. 1715.1. — *Piscicultural societies.* Garganico, P. 1865.1; Negri, L. 1874.1.

Netherlands

General accounts. Bont, M. J. 1863.1, 2, 1867.1, 1873.1; Duparc, H. M. 1854.1.

Pisciculture — Cont'd.

Miscellaneous papers. Pollen, F. P. 1870.1, 1871.5; Snellen von Vollenhoven, — 1854.1; Winkler, T. C. 1857.6; Anon. 325; Haack, H. Add. 1881.1; Mulier, W. Add. 1900.1. — *Piscicultural establishments.* Bettoni, E. & Vinciguerra, D. 1889.1. — *Establishment of J. A. Op de Macks, at Velp.* Op de Macks, J. A. 1870.1; Anon. 600. — *Societies for pisciculture.* Anon. 519.

Anchovy culture. Hoek, P. 1891.2; Hoek, P. & others 1886.1; Redeke, H. C. 1913.1, 1914.1. — *Carp culture.* Hoek, P. 1896.1. — *Salmon introduced, see above.*

Norway

Various papers. Aargaard, B. 1912.1; Schmidt, P. 1866.1; ★Wergeland, N. 1880.1, 2.

Experiments in keeping fishes in an impounded inlet of the sea. Hetting, M. G. 1873.1; Rasch, H. H. 1869.1, 1872.1.

Plaice culture at Trondhjem Station. Nordgaard, O. 1909.1, 1914.1.

Salmon culture. Archer, A. 1877.1, 1879.1; Landmark, A. 1897.1, 1909.1; Nordgaard, O. 1896.1, 1897.1, 2.

Marine Fish Hatchery at Flödevig near Arendal. — *Activities; chiefly hatching of cod.* Dahl, K. 1906.1, 2, 1909.2; Dahl, K. & Dannevig, G. 1906.1; Dannevig, G. M. 1885.1–1911.2; Rognerud, C. 1889.1. — *Foreign comment, notes, etc., on this work.* Baudouin, M. 1897.1, 2; Cori, C. J. 1906.3; Loisel, G. 1913.1; Raveret-Wattel, C. 1890.1, 1906.2; Redeke, H. C. 1907.1; Smith, H. M. 1907.3.

Portugal

Mello de Mattos, J. 1894.1; Nobre, A. 1893.1.

Russia

General treatises, text in Russian. Chmélevskij, Gracianov, Hindze & others. 1907.1; Venyaminov, N. 1876.1.

Miscellaneous papers. Arnold, J. N. 1905.1, 1906.1; Bauer, P. 1892.1; Borodin, N. A. 1905.1; Chodnew, S. 1872.1; Grimm, O. 1882.1; La Blanchère, P. 1877.3; Sodoffsky, W. 1858.1; Soudakèvicz, T. 1873.1, 1876.1; Zograf, N. Y. 1894.1, 1895.2; Anon. 670; Haack, H. Add. 1881.1.

Piscicultural stations. Knoch, J. 1869.1. — *Station of Nikolsk. Foundation by Wrassky.* Borsenkow, J., Usow, S. & Rouillier, C. 1859.1. — *Activities of station.* Doppelmaier, G. G. 1906.1; Grimm, O. 1905.1; Lebedintsev, A. A. & Eglit, P. I. 1907.1–1909.1; Soudakèvicz, T. 1876.1; Voelkel, P. 1870.1.

Black bass and brook trout introduced, see above. For culture of sturgeon, see likewise.

Various localities. Astrachan. Kavraiskii, T. T. 1913.1; Mitropolskii, S. 1907.1. — *Mogilev.* Kozubov, V. 1902.1. — *Ural region.* Kuchin, I. B. 1909.1, 2, 1910.1, 2. — *Nijné-Taguisk.* Malischeff, P. 1856.1. — *Herring in Volga R.* Mitro-

polskii, S. 1909.1. — *Lapland, Kusomen.* Randelin, O. 1885.1. — *Poland.* Raveret-Wattel, C. 1884.2; Strzelecki, A. & Baratyński, L. 1877.1. — *Baltic provinces.* Zur Mühlen, M. 1908.1. — *In Governments of Grodno, Kovno, and Vilna.* Anon. 223.

Finland. *General treatises.* Edlund, G. W. 1884.1, 1886.1; ★Holmberg, H. J. 1860.3.

Miscellaneous papers. Buhse, F. A. 1862.1, 2; Dahlberg, A. 1897.1; Hildebrand, W. 1897.1; Jalkanen, J. 1893.1; Jernström, L. A. 1871.1; Juselius, — 1905.1; Malmgren, A. J. 1869.1 (*History*); ★Nordqvist, O. F. 1890.1–1914.1; ★Sandman, J. A. 1892.1–1911.1, 1903.1; Schneider, G. 1904.20; Sjögren, A. J. 1828.1; Tiberg, H. V. 1896.1; Tiburtius, T. 1894.1; Werner, — 1883.1.

For fish-culture experiments on lakes of Evois, see Stations & Laboratories, under Fisheries.

Various fishes cultivated in Finland. — *Perch.* Huebner, A. 1898.1. — *Carp.* Sandman, J. A. 1892.4. — *Whitefish.* Serlachius, G. A. 1898.1. — *Grayling.* Steuert, L. 1900.1. — *Eel.* Trybom, F. 1893.1. — *Salmon and trout.* Buhse, F. A. 1862.2; Grönvall, A. J. 1892.1; Meyer, — 1899.1; Nordqvist, O. F. 1892.1, 1893.5, 1895.5; Sandman, J. A. 1895.6.

Spain

General treatises. Graells, M. 1864.1, 1867.1; Wicht, V. 1905.1.

Miscellaneous papers. Fernandez de los Senderos, F. 1850.1; Sauvage, H. E. 1889.3; Sagra, R. 1857.1; Villars, B. 1885.1; Nava y Caveda, H. 1878.1. — *Salmon and trout at Piedra.* Muntadas, F. 1869.1–1889.1.

Sweden

General treatises. Cedarström, G. C. 1857.1; Limborg, H. 1880.1; Malm, A. W. 1860.3.

Miscellaneous papers. Björkmann, — 1785.1; Lindstedt, P. 1911.1; Lönnberg, A. J. 1905.1, 2; Raveret-Wattel, C. 1906.2; Trybom, F. 1903.4; Widegren, H. 1865.1; Haack, H. Add. 1881.1. — *Finspong.* Lundberg, R. 1901.1. — *Anneboda Society, activities.* Nordqvist, O. F. 1906.4, 1910.2, 5, 1911.1, 1913.1. — *Engelsberg.* Schneider, G. 1909.3.

Various fishes. — *Perch.* Lönnberg, A. J. 1899.8. — *Carp.* Trybom, F. 1887.1. — *Salmon.* Malm, A. W. 1860.3, 1863.3; Widegren, H. 1865.3; Yhlen, G. 1880.2.

Early attempts at cultivation by confining adults in submerged boxes until spawning. Lund, C. Fr. 1761.1, 1765.1, Add. 1761.1.

Switzerland

Miscellaneous and general. Asper, G. 1890.1, 1891.1 (*Gen. treat.*); Denys, R. & Hausser, — 1894.1; Fankhauser, F. 1889.1, 1896.1; Loës, A. 1869.1–1880.1; Puenzieux, A. 1891.1, 2, 3; Rochette, G. 1858.1; ★Schoch, G. 1874.1–1896.1; ★Surbeck, G. 1908.4, 1911.4, 7; Thoulet, J. 1890.1; Vouga, P. 1872.1; Wattenwyl,

F. [n. d.]; Wirth, F. 1893.1; Anon. 752.

Salmon and trout culture. Blanc, H. 1891.1-1899.2; Goll, H. 1887.1; Heuscher, J. 1904.1; Steuert, L. 1898.1; Wengen, - 1869.1; Anon. 84.

Salmon, trout, and whitefish introduced, see above.

Piscicultural establishments. Bettoni, E. & Vincigeurra, D. 1889.1; Byström, C. 1864.1.

Various localities. *Vaud (Canton).* Chatelanat, H. 1880.1; Chavannes, A. 1865.1; Matthey, L. 1880.1; Nicati, C. 1874.1; Anon. 230. — *Neuchâtel.* Fuhrmann, O. 1903.4. *Arnon.* Junod, - 1854.1. — *Zurich.* Maendli, - 1890.1. — *Schaffhausen.* Moser-Ott, - 1880.2. — *Lake Geneva.* Raveret-Wattel, C. 1890.3; Vaucher, A. 1880.1. — *Glarus.* Schmid, C. 1885.1. — *Erlach.* Simmen, T. 1868.1. — *Lake of Lucerne, and Reuss R.* Wey, A. 1887.1; Winkler, J. 1890.1. — *Zug.* Weiss, - 1890.1.

Turkey

Constantinople. Lindes, L. 1880.11.

NORTH AMERICA

Alaska

Chiefly salmon operations. Bean, T. H. 1911.7; Bower, W. T. 1911.1; Evermann, B. W. 1905.11; Raveret-Wattel, C. 1915.3.

Canada

Salmon operations. Cochran, F. 1876.1 (*Nova Scotia*); Philips, B. 1875.7; Todd, F. 1882.1 (*Restigouche R.*); Vibert, P. 1876.1.

Various localities. — *Nova Scotia.* Melish, J. T. 1879.1; Sinclair, - 1867.1. — *Newfoundland.* Philips, B. 1874.2.

Miscellaneous items. Bean, B. A. 1889.4; Goode, G. B. 1883.16; Prince, E. E. 1900.1; Whitcher, W. F. 1883.1; Found, W. A. Add. 1912.1.

United States

For introduction of carp, Rhine salmon, shad, and European whitefish, *see above.*

Historical papers relating to the beginning and development of fish-culture in the United States. Austin, A. 1900.1; Cheney, A. N. 1898.4; Garlick, T. 1884.1; ★Goode, G. B. 1881.2; Kinder, 1879.1; ★Milner, J. W. 1874.4; Potter, E. D. 1891.1; Roosevelt, R. B. 1878.1; Nevin, J. Add. 1911.1; Stone, L. Add. 1898.1.

Alabama. *Shad culture.* Cooper, M. A. 1874.1; Daniell, W. C. 1874.1; Smiley, C. W. 1883.12.

Arkansas. *Trout exps.* Hyerson, P. 1891.1.

California. *Miscellaneous.* Bean, T. H. 1911.4; Borne, M. 1875.5; Hooper, E. J. 1875.2, 8; Raveret-Wattel, C. 1898.1; Reed, C. F. 1870.1; Ward, E. D. 1900.1.

Acclimatization of carp, shad, striped bass, etc. ★Smith, H. M. 1896.3.

For salmon operations, chiefly on McCloud R. at Baird, see Salmon culture, above.

District of Columbia. *Central station, report of operations.* McDonald, M. 1884.8, 1885.3. — *Operations at navy yard station, report.* Wood, W. M. 1884.5.

Florida. *Misc.* Fisher, F. B. 1882.1. — *Suitability of Biscayne Bay as site for marine hatching station.* Smith, H. M. 1896.2.

For shad operations, see Shad culture, above.

Indiana. *Miscellaneous.* Bean, T. H. 1911.9; Philips, B. 1874.2; Wilson, C. A. 1883.1. — *Trout culture.* Langguth, T. G. Add. 1913.1. — *The beginning of some state fish hatcheries.* Miles, G. W. Add. 1913.1.

Iowa. *Miscellaneous.* Evermann, B. W. 1894.4; Mosher, A. A. 1885.1; Pettit, H. W. 1865.1.

Kansas. *New fish hatchery.* Dyche, L. L. Add. 1914.1, 2.

Maine. *Miscellaneous papers.* Bean, T. H. 1891.12; Boardman, S. L. 1863.1; Philips, B. 1874.2. — *Introduction of Great Lakes whitefish.* Buck, H. H. 1883.1. — *Introduction of black bass.* Page, G. S. 1881.1, 1885.1.

For propagation of Atlantic and land-locked salmons, see Salmon culture, above.

Maryland. *Delaware R. operations, chiefly shad propagation at U. S. Fish Comm. station at Havre de Grace.* Clark, F. N. 1885.2; Grabill, L. R. 1887.1; Hamlen, W. 1884.1, 1885.1, 1886.1; Low, W. F. 1885.1; Meehan, W. E. 1908.1; Piepmeyer, L. W. 1885.1; Ravenel, W. 1889.2, 3; Slack, J. H. 1874.1; Taylor, F. W. 1883.1.

Shad operations at Fort Washington, on the Potomac R. Babcock, W. C. 1885.1, 1886.1; McDonald, M. 1885.4, 1887.9, 1889.3, 4. — *on Chester R.* Kent, A. 1876.1.

Massachusetts. *Miscellaneous papers.* Bean, T. H. 1911.13; Dexter, E. 1870.1; Gilbert, W. L. 1882.1; Hyde, J. F. 1874.1; K., J. N. 1878.1; Peabody, G. A. 1863.1; Shattuck, L. 1835.1; Belding, D. L. Add. 1914.1. — *Early citation in Kalm, P. 1761.1 of transplanting "herring" from one river to another.* Brewer, W. H. 1874.1.

For propagation of cod at Woods Hole, see Cod culture, above.

Michigan. *Miscellaneous papers.* Bean, T. H. 1891.13; Bower, S. 1910.1 (*Rainbow trout*); Dickerson, F. B. 1904.1; Golcher, W. 1877.1; Post, H. 1894.1. — *Bass.* Reighard, J. E. 1906.1.

See also above under Whitefish culture for operations in Michigan.

Missouri. *Introduction of rainbow trout.* McDonald, M. 1887.1, 1890.1. — *St. Louis, Forest park fish culture.* Anon. 169.

Montana. *Stocking streams.* Crosby, J. S. 1883.1. — *Grayling culture.* Henshall,

Pisciculture — Cont'd.

J. A. 1907.1. — *Need for fish-way in Pend d'Oreille River*. Waterbury, E. B. & others. 1883.1.

Nevada. Bean, T. H. 1911.14. — *Carp introduced*. Pasco, I. D. 1882.1.

New Hampshire. *Miscellaneous papers.* Bean, B. A. 1892.4; Bean, T. H. 1890.20; Philips, B. 1875.6; Webber, S. 1878.1, 1879.1. — *Nashua R., stocking*. G., A. F. 1877.1. — *Setting out landlocked salmon*. Hodge, E. B. 1885.1.

New Jersey. *Trout culture.* Clarke, H. R. 1885.1. — *Fish protection.* Frothingham, H. P. 1897.1. — *Pond culture.* Hughes, S. E. 1882.1. — *Navesink R., operations.* Mason, H. W. 1882.1. — *Planting of salmon.* Peirce, M. P. 1877.2; Slack, J. H. 1874.2, 1876.1.

New York. *Miscellaneous papers.* Cheney, A. N. 1897.1, 1898.3, 1900.1; Evermann, B. W. 1904.6; Green, S. 1872.1, 1874.4; Lambert, T. S. [n. d.]; Holland, F. H. 1868.1; J., I. Q. 1874.1 (*trout*); Way, J. H. 1880.1.

Various localities. — *Lake George.* A., J. 1876.1. — *Lake Champlain.* Baird, S. F. 1875.36; Edmunds, M. C. 1874.1; Stone, L. 1902.1. — *Westmoreland.* Hallock, C. 1874.1. — *Cold Spring Harbor.* McDonald, M. 1884.10; Mather, F. 1885.2–1889.3; *Otsego Lake.* Phinney, E. 1880.1, 2, 4. — *St. Lawrence reservation.* Strough, A. B. 1902.1.

Yellow perch from Skaneateles introduced into Otisco Lake. G., W. 1841.1. — *Annual reports of state fish culturist.* Bean, T. H. 1907.2, 1911.3, Add. 1910.1, 1911.1. — *State hatcheries, report, 1904–1906.* Lawrence, J. D. 1904.1. — *Removal of lampreys from interior waters.* Surface, H. A. 1899.1.

Atlantic salmon introduced, see above.
See also above under Smelt, and Sturgeon culture.

North Carolina. *Opening Broad River.* Coxe, F. 1884.1. — *Planting of bass.* Smiley, C. W. 1883.6.

See also above under Striped bass culture.

North Dakota. Barrett, W. W. 1900.1.

Ohio. *Varia.* — *Castalia Springs.* Baird, S. F. 1874.6. — *Suitable waters for trout.* Evermann, B. W. 1898.7. — *Practicability of eel planting.* Philips, B. 1878.3. — *Impropropriety of planting whitefish off Cleveland.* Sterling, E. 1883.1.

Oregon. *Salmon hatcheries.* Finely, C. I. 1884.1; Walker, C. H. 1885.1. — *Clackamas R. salmon station, operations.* Hubbard, W. F. 1880.1; Stone, L. 1879.3. — *Rogue R. operations.* Pratt, K. B. 1880.1. — *Hood R.* Smith, E. L. 1887.1.

Pennsylvania. *Miscellaneous papers.* Bean, T. H. 1892.12, 1910.10; James, B. W. 1896.1–1902.1; Meehan, W. E. 1900.1–1907.1; Nixon, P. 1874.1; Wetherill, C. Add. 1901.1. — *Fishways.*

Worrall, J. 1875.1, 1876.1. — *Trout culture. History.* Meehan, W. E. Add. 1897.1.

Rhode Island. *Stocking waters with fresh-water fishes.* Anon. 525.

Texas. *San Marcos station, activities, description, etc.* Leary, J. L. 1904.2–1912.1. — *Carp culture.* Yoakum, F. L. 1883.1.

Utah. *Eel introduced.* Baird, S. F. 1874.24. *Salt lake.* Perrin, M. L. 1874.1. — *Panguitch and Bear lakes.* Siler, A. L. 1884.1. — *Large-mouthed black bass.* Sharp, J. Add. 1898.1.

Vermont. *Report, 1857.* Marsh, G. P. 1857.1.

For operations in Lake Champlain, see Sturgeon culture above.

Virginia. McDonald, M. 1876.1, 1880.2; *Calif. trout in Roanoke R.* 1884.1; *Spanish mackerel investigations at Cherry-stone.* 1884.11; *Trout station, Wytheville.* 1887.8, 1889.2.

Wisconsin. Bean, T. H. 1891.24; Hoy, P. R. 1876.1. — *Muscallonge.* Nevin, J. 1902.1.

SOUTH AMERICA

Argentina. *First fish-hatchery in South America established at Lake Nahuel Huapi.* Titcomb, J. W. 1906.1.

Introduction of American fishes; trouts, and salmons. Lahille, F. 1905.1; Titcomb, J. W. 1910.1; Tulian, E. A. 1910.1, Add. 1911.1.

Brazil. Ihering, R. 1912.1. — *Introduction of carp.* Couchman, J. W. 1883.1.

Chile. *Piscicultural activities.* Golusda, P. 1912.1–1912.6.

Introduction of California salmon and saibling. Albert, F. 1902.1, 1906.1, 1907.1; Cerda, J. 1885.1; Sage, C. 1912.1; Smith, W. A. 1897.1. — *French fishes.* Jousset de Bellesme, G. L. Add. 1888.1.

Introduction of goldfish into rivers. Lataste, F. Add. 1894.1.

OCEANICA

Australia. *Victoria.* Allport, C. 1874.1. — *New South Wales.* Gale, A. 1904.1. — *Plaice and sole brought from England to Australia.* Dannevig, H. C. 1902.2.

Macquaria australisica and Percalates fluviatilis transplanted in N. S. W., and Queensland. Stead, D. G. 1914.1; O'Connor, D. Add. 1897.1.

For introduction of the various salmons and trouts, and whitefish, see above.

Dutch East Indies. *Cultivation of fresh-water fishes.* Holle, K. F. 1861.1, 1871.1, 1873.1. — *Java.* Dabry de Thiersant, P. 1869.1; Eijk, J. A. 1873.1; Gorkom, K. W. 1868.1; Spall, P. W. 1864.1, 1865.1.

Hawaiian Is. *Native pond culture.* Cobb, J. N. 1906.2.

New Zealand. *Miscellaneous papers.* Creighton, R. J. 1881.1; Seed, W. 1887.1. — *Salmon, European trout, and whitefish introduced, see above.*

Philippine Is. Pond culture. Radcliffe, L. 1912.3. — *Black bass introduced, see above.*

Tasmania. Salmon and trout introduced, *see above.*

PLANKTONIC FAUNA

Comprising pelagic ova and larvæ of marine Teleostean fishes

For all literature on non-pelagic eggs. *see* Ova and ovum.

Pelagic Larval Fishes

Descriptions of various pelagic larvæ.

★Agassiz, A. 1878.1, 1883.1, 1886.1; ★Agassiz, A. & Whitman, C. O. 1885.1; Ryder, J. A. 1887.2.

Miscellaneous papers. Borodin, N. A. 1903.1; Damas, D. 1909.2; McIntosh, W. C. 1890.4; Nordqvist, O. F. 1914.1; Pycraft, W. 1912.1.

References to early developmental stages of larvæ of non-pelagic forms will be found under the fishes in the last section, under Embryology.

Metamorphosis of larval fishes.

Miscellaneous and general. Gegenbaur, C. 1865.1; Joly, N. 1872.2; Jürss, H. 1913.2; ★Lütken, C. F. 1880.3, 1881.1; Meunier, A. V. 1867.1; Vinciguerra, D. 1880.1.

Metamorphosis of — Zeus faber. Agassiz, J. L. 1865.2; Harting, P. 1865.2; Lubach, D. 1865.1; Salverda, M. 1865.1. — *Trachypterus.* Emery, C. 1879.1 (I). — *Syngnathus lumbriciformis.* Fries, B. F. 1837.2. — *Mullus.* Lo Bianco, S. 1908.2. — *Scopelidæ.* Mazzarelli, G. F. 1912.1. — *Lepidopus.* Raffaele, F. Add. 1889.1.

For metamorphosis of larval stages of Pleuronectidæ, including rotation of the eye and changes in optic tract, see Pleuronectidæ.

Further data on metamorphosis will probably be found in the papers cited under the fish below in the sub-section Various Ova and Larval Fishes.

For transformation of the Leptocephalus stage see under Anguilla; for Ammocoetes or larval lamprey, see Petromyzon.

Post-larval stages. Fabre-Domergue, P. & Biétreix, E. 1897.1; McIntosh, W. C. 1887.1, 1889.2. — *Antarctic fishes.* ★Regan, C. T. 1916.3. — *North Atlantic fishes.* ★Schmidt, E. J. 1904.2–1909.1.

For post-larval stages of particular marine fishes, see under the fish in section Various Ova and Larval fishes below.

Pelagic Ova

Methods of determination with tables, and descriptions of various species. ★Agassiz, A. & Whitman, C. 1885.1; Ehrenbaum, E. 1911.4; ★Heincke, F. & Ehrenbaum, E. 1900.1, 1903.1; Williamson, H. C. 1899.1; Zur Mühlen, M. 1911.16.

Specific gravity of ova. Franz, V. 1910.11; Jacobsen, J. P. & Johansen, A. C. 1908.1; Ryder, J. A. 1886.12. — *Distribution by currents.* Johnstone, J. 1903.1; Redeke, H. C. 1909.1. — *Quantitative distribution*

throughout North Atlantic. Lohmann, H. 1903.1. — *Variations in size.* Williamson, H. C. 1895.3.

Floating "rafts" of jelly with imbedded eggs of Lophius. Agassiz, A. & Whitman, C. 1885.1; Fulton, T. W. 1898.3; Prince, E. E. 1891.1; Williamson, H. C. 1911.2.

For the so-called Pelagic "nests," of Antennarius, see Nest-building under Reproduction.

Plankton Surveys

Results of studies made in various localities on the ova and larvæ of fishes with descriptions of the various forms.

British investigations. *Ova and larval fishes from waters around Scotland.* ★Cunningham, J. T. 1888.1; Fulton, T. W. 1890.1; McIntosh, W. C. 1894.2, 1895.1; Williamson, H. C. 1899.1, 1911.2, 4; Herdman, W. A. & Riddell, W. Add. 1912.1. — *Collections of S. S. Garland (1890–1896) of Fishery Board for Scotland.* Kyle, H. M. 1897.2; McIntosh, W. C. 1890.6; Masterman, A. T. 1893.1, 1897.2; Wallace, W. 1896.1; Williamson, H. C. 1895.1; Williamson, H. C. & Tosh, J. R. 1894.1.

Report on fish-egg cruise of S. S. "Huxley," 1909. Buchanan-Wollaston, H. J. 1911.1.

Teleostean ova and larval forms observed at the Marine Biol. Lab., Plymouth. Browne, F. B. 1903.1; Cunningham, J. T. 1889.3, 4, 1891.6; Hefford, A. E. 1910.1; Holt, E. W. 1897.5; Holt & Byrne, L. W. 1897.1; Holt & Scott, S. D. 1897.1; Clark, R. S. Add. 1914.1.

Ova from Irish Sea and the Isle of Man. Scott, A. 1905.1, 2, 1906.1, 1913.3, 1914.2, 1915.1; Herdman, W. A. & Scott, A. Add. 1911.1.

Investigations, west coast of Ireland. Cunningham, J. T. 1891.10, 1900.1; ★Holt, E. W. 1891.5, 1893.4.

Dutch investigations. *Ova and larval forms of North Sea fishes.* Boeke, J. 1906.1; Hoek, P. P. 1888.1; Hoek, P. & Ostensfeld, C. H. 1906.1; Ostensfeld, C. & Wesenberg-Lund, C. 1909.1; Redeke, H. C. & Breemen, P. J. 1908.1; Tesch, J. J. 1909.1–1914.2.

German investigations. *Methods and results.* Jenkins, J. T. 1901.1.

Baltic Sea investigations. ★Ehrenbaum, E. & Strodtmann, S. 1904.1; Heinen, A. 1912.1; Hensen, V. 1883.1, 1884.1, 1901.2; Merkle, H. 1910.1; Pietschmann, V. 1914.1.

North Sea investigations. Ehrenbaum, E. 1897.1, 1909.1, 1910.2, 1911.3; Heincke, F. 1905.1; ★Hensen, V. & Apstein, C. 1897.1; Strodtmann, S. 1908.1.

Other localities. *Ova and larvæ from — South Africa.* Gilchrist, J. D. 1903.2, 3, 1904.1. — *Barents Sea.* Linko, A. 1907.1. — *Mediterranean Sea.* Cialona, M. 1901.1; Facciola, L. 1884.1; Fage, L. 1910.1; Mazzarelli, G. F. 1910.1–1912.1; Raffaele, F. 1887.1, 1888.1. — *Marseilles, France.* Holt, E. W. 1897.6, 1899.1;

Plankton — *Cont'd.*

Marion, A. F. 1894.9. — *Adriatic Sea*.
Steuer, A. 1913.1, 1914.1.

North Atlantic and contiguous waters.
— *Skagerrak*. Aurivillius, C. W. 1898.1,
1899.1. — *Faeroe channel*. Holt, E. W.
1898.5. — *Bay of Biscay*. Holt & Byrne,
L. 1907.1. — *Bay of Hougue, France*.
Perrier, J. & Anthony, R. 1907.1. — *Baltic*
Sea. Schneider, G. 1907.4. — *Danish*
waters. Apstein, C. 1911.1; Kramp, P.
L. 1913.1; Otterstrøm, A. N. 1906.2;
Petersen, C. G. 1903.2.

**VARIOUS OVA AND
LARVAL FISHES**

*Comprising special papers describing or
relating to the planktonic ova and pelagic
larval stages of marine teleostean fishes, and
including free-swimming post-larval and
young forms of these and of forms having
"fixed" or attached ova.*

Sub-order Acanthopterygii

Gobiiformes. — *Crystallogobius*. McIntosh, W. C. 1896.4.

Jugulares. — *Trachinus*. Boeke, J.
1907.1. — *Blennius*. Byrne, L. W.
1902.1; Emery, C. 1879.1 (viii); Nobre,
A. 1895.4; Quatrefages, J. L. 1843.1. —
Callionymus. Cunningham, J. T. 1891.2;
McIntosh, W. C. 1886.2; Prince, E. E.
1891.2. — *Centronotus*, *Lumpenus*, and
Lepadogaster. McIntosh, W. C. 1890.2,
1895.1, 1897.1. — *Uranoscopus*. Fage,
L. Add. 1914.2.

Perciformes. — *Chaetodon*. Günther,
A. C. 1871.7, 1876.4. — *Acronurus*.
Hilgendorf, F. M. 1883.1. — *Pomatomus*.
Nichols, J. T. 1914.1. — *Sparus*. Wil-
liamson, H. C. 1911.2, 4.

Scleroparei. — *Cyclopterus*. Cunning-
ham, J. T. 1888.1. — *Dactylopterus*
(*Cephalacanthus* is the larval form). Hil-
gendorf, F. M. 1883.1. — *Trigla*. Jaquet,
M. 1907.3. — *Cottus*. McIntosh, W. C.
1888.3.

Scombriformes. — *Scomber*. Cunning-
ham, J. T. 1891.4; Marion, A. F. 1894.8;
Sanzo, L. 1910.4. — *Xiphias*. Günther,
A. C. 1876.4; Sanzo, L. 1910.3; Steen-
strup, J. J. 1861.1. — *Alectis*. Osburn,
R. C. 1910.10. — *Auxis*. Sanzo, L.
1909.1.

Tæniosomi. — *Trachypterus*. Jacino,
A. 1908.1, 1909.1; Lo Bianco, S. 1908.3;
Ogilby, J. D. Add. 1888.3.

Zeorhombi. — *Zeus*. Schmidt, E. J.
1908.2; Stiasny, G. 1914.1.

For eggs and larvæ of flat fishes, see
under *Pleuronectidæ* in Systematic section.

Sub-order Anacanthini

Macruridæ. Emery, C. 1879.1 (ix);
Facciola, L. 1882.4.

Gadidæ. Hoek, P. P. C. 1911.2; Lo
Bianco, S. 1911.2; Redeke, H. C. 1909.1;
Schmidt, E. J. 1909.1; Redeke, H. C. &
Breemen, P. J. van. 1908.1. — *Motella*.
Brook, G. 1887.2. — *Phycis*. Facciola,
L. 1883.2; McIntosh, W. C. 1906.1;
Yarrow, H. C. 1877.2. — *Gadus*. Hoek,
P. 1903.1, 1911.2; McIntosh, W. C.

1886.5, 1894.2, 1895.1, 1897.1; Otter-
strøm, A. N. 1906.3; ★Schmidt, E. J.
1904.3, 1905.1, 1906.4. — *Molva*. McIn-
tosh, W. C. 1885.2; Schmidt, E. J.
1906.3, 1907.3; Dunn, M. Add. 1885.3.
— *Brosmius*. Schmidt, E. J. 1905.2;
Williamson, H. C. 1911.2. — *Merluccius*
and *Raniceps*. Schmidt, E. J. 1907.2,
1907.3, 1908.1.

Sub-order Haplomi

Scopelidæ. Emery, C. 1879.1; Holt, E.
W. 1898.1; Mazzarelli, G. F. 1912.1;
Sanzo, L. 1915.2. — *Clorophthalmus*.
Facciola, L. 1884.2. — *Stylophthalmoide*
as larva of *Scopelus*. Sanzo, L. 1915.2.

Sub-order Heteromi

Fierasfer. Edwards, T. 1863.2; Fulton,
T. W. 1904.1; McIntosh, W. C. 1898.1;
Nusbaum, J. & Bykowski, L. 1905.1.

Encheliophis is the larval form of
Fierasfer. Putnam, F. W. 1874.4.

Sub-order Malacopterygii

American Clupeidæ. Prince, E. E. 1907.1.
— *Clupea pilchardus*. Biérix, E. 1891.1;
Fabre-Domergue, P. & Biérix, E. 1896.1,
.2; Pouchet, G. & Biérix, E. 1889.1,
.2, 6. — *Herring*. Dunn, M. 1897.1;
Günther, A. C. 1868.5; Masterman, A.
T. 1896.2. — *Clupea alosa finta*. Nord-
qvist, O. F. 1902.1. — *Gonostoma*. Fac-
ciola, L. 1884.3; Sanzo, L. 1912.1. —
Megalops. Kampen, P. N. 1909.3. —
Engraulis. Marion, A. F. 1894.8; Redeke,
H. C. 1913.1. — *Synodus*. Nichols, J.
T. 1911.1. — *Chauliodus*, *Stomias*, *Ster-
noptychidæ*. Sanzo, L. 1912.2, 3, 1915.2.
— *Argentina*. Schmidt, E. J. 1906.2. —
Bathylchnus. Steuer, A. Add. 1911.1.

Sub-order Percosoces

Ammodytes. McIntosh, W. C. 1892.2;
— *Belone*. Cornish, T. 1885.4; Day, F.
1885.13; Hohnbaum-Hornschuch, R.
1843.1; Hoeven, J. 1843.1; Putnam, F.
W. 1865.5. — *Centrolophus*. Borsieri, C.
1902.1; Holt, E. W. 1891.4. — *Exocætus*.
Lütken, C. F. 1874.1; Raffaele, F. 1895.2.
— *Scomberesox*. Raffaele, F. 1895.2;
Steuer, A. Add. 1911.1. — *Hemirham-
phus*. Weber, M. 1913.2.

**Ova, larvæ, and young of fishes of
various other Sub-orders**

Amphisile. Duncker, G. 1911.1. —
Lophius. Günther, A. C. 1861.10; Stiasny,
G. 1911.1, 1913.1; Steuer, A. Add. 1911.1.
— *Fistularia*. Hilgendorf, F. M. 1877.1.
— *Mola*. McCulloch, A. R. 1912.1;
Perugia, A. 1889.2; Putnam, F. W.
1870.4; Reuven, C. L. 1895.4. — *Nemich-
thyidæ*. Roule, L. 1910.2, 1911.2, 1912.1,
1913.4, 1914.1, 5. — *Bathophilus*. Sanzo, L.
1915.2. — *Chlopsis*. Schmidt, E. J. 1913.2.

POISONOUS FISHES

For toxic effects, when injected, of blood
serum of fishes, especially *Anguilla*, see under
Blood of fishes.

For a recent valuable work in French,
with an extensive bibliography, treating the

entire subject of poisonous fishes, including both poison apparatus and poisonous flesh, see ★Marie Phisalix. "Animaux venimeux et venins." Paris. 1922. vol. II, pp. 487-628, illustrations.

General treatise. Coutière, H. 1899.1. — *Accounts in "Medical Zoologies."* Brandt, J. F. & Ratzeburg, J. T. 1829.1; Moquin-Tandon, C. H. 1860.1; Stephenson, J. 1838.1; Taschenberg, E. O. 1909.1.

Miscellaneous items. Autenrieth, H. F. 1833.1; Berkowsky, —. 1859.1; Dickson, J. H. 1818.1; Dönitz, F. K. 1873.1; Kalm, P. 1761.1; Leonhardt, E. E. 1904.10; Wuth, E. M. 1877.1; Anon. 264-266, 357, 451, 454; Klimenko, W. S. Add. 1894.1; Knoch, J. Add. 1888.1; Schmidt, N. Add. 1891.1; Vasilyeff, S. M. & Mochaloff, M. I. Add. 1885.1. — *Pre-Linn. refs.* Linocier, G. 1584.1; Piso, G. 1648.1.

Alleged Dental Apparatus of *Muraena*

*Descr. of venomous apparatus similar to serpents, formed by palatine teeth with associated mucous glands, in *Muraena helena*.* Bottard, A. 1889.2; Porta, A. 1905.2. — *Popular résumé of Bottard.* Bordas, L. 1907.1.

Investigations of palatine structure and disbelief of presence of poison glands. Coutière, H. 1902.1, 1907.1; Galasso, F. 1901.1; Pavlovskii, E. 1909.1, 4.

Poison Apparatus Composed of Spines and Associated Glands

General accounts of structure, functions, etc. Bassett-Smith, P. W. 1903.1; ★Bottard, A. 1889.1, 1889.2; Porta, A. 1905.2; ★Pavlovskii, E. 1907.1, 1909.1; Fredericq, L. Add. 1910.1; Lipp, F. J. Add. 1829.1; Paré, A. Pre-Linn. 1575.1.

Treatment of wounds, anti-venomous serotherapy, etc. ★Calmette, A. 1907.1, 2; Bassompierre, — & Schneider, — Add. 1899.1; Lacoste, L. Add. 1911.1.

Miscellaneous papers. Cecca, R. 1902.1; O'Shaughnessy, A. W. E. 1867.1; Thilo, O. 1898.3, 1899.3; Anon. 189, 450; Bottarel, A. Add. 1889.1; Hasselt, A. W. Add. 1862.1; Munier, Add. 1774.1; Sauvages, —. Add. 1764.1. — *Analogy of lesions and symptoms with snake bites.* Corré, A. Add. 1872.1, 1881.1. — *Early ref.* Hanow, M. Pre-Linn. 1737.1.

*For dangerous wounds (non-poisonous) made by the sting-ray, *Trygon*, see Aubert, H. 1861.1; Mordecai, E. R. 1860.1.*

Batrachus. *Axillary gland, commonly thought poisonous, is shown not to be.* Wallace, L. B. 1893.1.

Scorpænidæ. *Poison apparatus, structure.* Pavlovskii, E. 1907.2, 1911.1, 3; ★Sacchi, M. 1895.1. — *Nature and effects of *Scorpæna* poison.* Briot, A. 1904.1, 1905.1; Pohl, J. 1893.1; Dunbar-Brunton, J. Add. 1896.1.

*Effects of poisons and cases of poisoning in *Synanceia*.* Harting, P. 1865.5; Le Juge, E. 1871.1; Schnee, S. 1911.1; Anon. 399, 587. — *Notesthes.* Kesteven,

L. 1914.1; Woods, J. E. 1882.1. — *Pterois.* Schnee, S. 1908.2.

Siluridæ. *Structure of poison glands and spines in — *Ictalurus dugesii*.* Alemán, J. 1891.1; Dugès, A. 1891.1. — **Plotosus*.* Pavlovskii, E. 1913.1-1914.2. — **Piratinga filamentosa*.* Pettit, A. & Geay, F. 1901.1. — **Noturus* and *Schilbeodes*.* ★Reed, H. D. 1900.1, 1907.1, Add. 1906.1.

Thalassophryne. *Anatomy of poison apparatus.* Dow, J. M. 1865.1; ★Günther, A. C. 1864.9, 1869.1; Harting, P. 1864.1; Anon. 211.

Trachinus. *Structure of poison apparatus.* Borley, J. O. 1907.1; Chievitz, J. H. 1888.1; Day, F. 1880.2; ★Gressin, L. 1884.1; ★Parker, W. N. 1888.1, Add. 1888.1; Pavlovskii, E. 1907.2; Schmidt, F. T. Add. 1875.1.

Discovery of venomous properties and poison glands. Allman, G. J. 1841.1; Byerley, I. 1849.1; Woodward, H. 1864.1.

Nature of poison and its effects, hemolytic action, etc. ★Briot, A. 1902.1-1904.2; Evans, H. M. 1907.1, 1910.1; Pohl, J. 1893.1; Phisalix, C. 1899.1; Dunbar-Brunton, J. Add. 1896.1. — *Review of Briot.* Mitchell, C. A. Add. 1906.3.

Records of poisoning cases. Spitzly, J. H. 1910.1; Bassompierre & Schneider Add. 1899.1; Bottard, —. Add. 1885.1; Willius, J. V. Pre-Linn. 1677.1. — *Case of death.* Ulmer, —. 1865.1

Poisonous Flesh through Presence of Alkaloids

It has not been possible here to distinguish between actual poisoning and ptomaine poisoning. For all papers relating specifically to sickness caused through eating decayed fish, either fresh or preserved, see under Diseases of man.

General treatises. See especially. ★Pellegrin, J. 1900.6; Savchenko, P. N. 1887.1; ★Vignon, G. Add. 1902.1.

Other general accounts. Coutière, H. 1899.1; Corré, A. 1865.1; Duméril, A. H. 1866.2, 1867.1; Fischel, F. & Enoch, C. 1892.1; ★Kobert, E. R. 1902.1, Add. 1894.1; Tybring, O. 1885.1, 1887.1. — *Text in Russian.* Popoff, M. Add. 1887.1.

Miscellaneous papers on the effects of eating poisonous fishes, with references to poisoning cases, etc. Burnett, W. 1846.1; Burrow, G. M. 1815.1; Elridge, S. 1879.1; Gmelin, J. F. 1788.1; Hamilton, W. 1853.1; Lim-Boon-Keng, — & Boddaert, A. 1901.1; Martin, M. 1834.1; Martini, —. 1898.1; Nicolas, C. 1909.1; Nordmann, A. 1863.1; Anrep, V. K. Add. 1885.1; Carruccio, A. Add. 1886.1; Chernisheff, S. P. Add. 1899.1; Cloquet, H. Add. 1821.1; Guyon, — Add. 1856.1; Mouchon, —. Add. 1840.1; Schreiber, J. Add. 1884.1. — *Effect on a cat.* Casselmann, A. 1871.1.

Cases of poisoning. *Records of occurrence, treatment, etc.* Danilewsky, C. 1885.1; Gautier, A. 1864.1; Sobbe, — 1889.1; Alexander, — Add. 1888.1

Poisonous Fishes—Cont'd.

Chevallier, — Add. 1856.1; Edwards, J. Add. 1884.1; Raillet, A. Add. 1895.1; Rostoshinski, R. P. Add. 1892.1; Savchenko, P. Add. 1882.1; Simsohn, J. S. Add. 1887.1; Spofforth, J. L. Add. 1886.1; Wilson, J. P. Add. 1887.1.

Poisoning from eating liver of — shark. Coutaud, H. 1879.1. — *Diodon*. Richardson, J. 1861.1. — *sword-fish*. Morrow, C. H. Add. 1896.1.

Poisoning cases from eating roe or eggs of — *Barbus meridionalis*. Pellegrin, J. & Glaize, E. P. 1903.1. — *herring*. Belin, J. Add. 1886.1. — *"rolled roe."* Bondareff, P. G. Add. 1898.1.

Poisoning from eating the bonito (Gymnosarda). Morvan, A. Add. 1857.1.

"Ciguatera," in West Indies. *Produced chiefly by puffers, filefishes, and toadfishes.* Chisholm, C. 1808.1; Ferguson, W. 1823.1; ★Hill, R. 1868.1; Meyer, F. D. 1805.1; Moreau de Jonnès, A. 1819.1; Morton, C. 1865.1; Parra, A. 1787.1; ★Poey, F. 1865.1; Anguita i Stüven, V. Add. 1897.1; Desports, J. B. Add. 1770.1; ★Fonssagrives, J. B. & Mericourt, L. Add. 1861.1; Janière, S. Add. 1831.1; Oldendorps, —. Add. 1777.1; Rogers, J. M. Add. 1899.1; Ulloa, A. Add. 1772.1; Chevalier, J. D. Pre-Linn. 1752.1; Locke, J. L. Pre-Linn. 1675.1; Martyr, P. Pre-Linn. 1504.1. — *Poisoning by barracuda*. Plée, — Add. 1829.1.

Tetrodon poisoning, chiefly in Japan. Bennett, G. 1870.1; Goertz, A. 1878.1; Osbeck, P. 1765.1, 1771.2; Pappe, C. W. 1854.1; ★Remy, C. 1883.1; Schreitmüller, W. 1910.14; ★Salanone-Ipin, H. Add. 1889.1.

Researches on nature, chemical composition and physiological action of Tetrodon poison. Tahara, Y. 1910.1, Add. 1896.1, 1912.1; Takahashi, D. & Inoko, Y. 1889.1, 1892.1; Hayashi, H. & Muto, K. Add. 1901.1; Miura, M. & Takesaki, K. Add. 1890.1.

Miscellaneous, text in Japanese or Russian. Akashi, T. 1880.1; Noro, K. 1880.1; Furuya, —. Add. 1881.1; Gubareff, P. M. Add. 1882.1; Osawa, K. Add. 1884.1; Takei, S. Add. 1831.1; Yamawaki, G. Add. 1883.1.

Various localities. *Cases of poisoning by eating, and lists of poisonous fishes of — southern Pacific Ocean.* Anderson, W. 1776.1; Brenchley, J. L. 1873.1; Wilson, J. Add. 1799.1. — *Mauritius I.* Baird, S. F. 1872.26; Sonnerat, P. & Meunier, V. 1774.1. — *Dutch East Indies.* Moreau de Jonnès, A. 1821.1; Woods, J. E. 1888.1. — *New South Wales.* Pattison, G. J. 1872.1. — *New Caledonia.* Roux, — (Jr.) 1860.1. — *Philippine Is., by Spheroides.* Seale, A. 1912.2, Add. 1912.1. — *Mediterranean.* Slyunin, N. V. Add. 1892.1. — *Marshall Is.* Steinbach, —. Add. 1895.1.

Belief in tropics that exposure to moon renders fish poisonous. Goode, G. B. 1879.8; Bryant, E. G. Add. 1912.1; Hutchins, D. E. Add. 1912.1.

POST-BRANCHIAL BODY

Called also Suprapericardial body.

For related structures, see Thymus, and Thyroid glands.

Morphology of the post-branchial body. Bemmelen, J. F. 1886.1; Giacomini, E. 1909.1, 1912.1; Herrmann, G. & Verdun, P. 1900.1; Maurer, F. 1886.1; Supino, E. 1907.2; ★Thompson, F. D. 1910.1.

PREDATORY FISHES

For the reverse, i. e. animals destructive to fishes, see Noxious organisms under Pisciculture. For a related topic, see Poisonous fishes.

Miscellaneous or popular articles on voracity of fishes. Anderson, A. 1879.1; Kornhuber, G. A. 1901.1; Steele, R. L. 1876.1.

Means of defense and attack, popular acc'ts. Brüning, C. 1903.2; Coupin, H. 1913.1; ★Cuénot, L. 1898.1; Faussek, V. A. 1908.1; Lönnberg, A. J. 1901.4.

Effects of wounds produced by sting-ray, Trygon. Aubert, H. 1861.1; Duméril, A. H. 1865.4; Mordecai, E. R. 1860.1. — *Wounds made by garfish, Belone.* Mühlens, P. 1904.1.

Barracuda dangerous to man. Brenchley, J. L. 1873.1. — *Devil-fish (Ceratoptera) interfering with submarine diver.* Anon. 60.

Cutting of a cable at Singapore by a sawfish (Pristis). Anon. 478.

Serrasalmo (Caribe) attacking men. Eigenmann, C. H. 1915.2; Paez, R. 1862.1; Roosevelt, T. 1914.1; Anon. 251; Lange, A. Add. 1912.1; Woodroffe, J. F. Add. 1914.1.

Sharks as man-eaters. Lucas, F. A. 1916.1; Smith, H. M. 1905.6, 1916.2; Swan, J. O. 1880.1; Griffen, S. Add. 1881.1.

Notes on the voracity of sharks. Duméril, A. H. 1865.4; Verney, (Lady) 1874.1; Anon. 252; Adams, A. Add. 1848.1; Becke, L. Add. 1905.1.

Swordfish in stomach of Carcharias. Atwood, N. E. 1864.3. — *Human remains in stomach of Carcharodon.* Condorelli-Fr., M. & Perrando, G. 1909.1. — *Acc'ts of sharks attacking boats.* Foulis, R. 1852.1; Putnam, F. W. 1874.9.

Swordfishes attacking vessels, and fighting whales. *Vessels pierced by weapon.* Gray, J. E. 1871.1; M'Calmont, R. 1844.1; Thompson, W. 1844.3; S., J. M. Add. 1835.1. — *Refs. in Pre-Linn. section.* Baeck, A. 1748.1; Josselyn, J. 1674.1; Mortimer, C. 1744.1. — *Man killed in boat attacked.* Wilcox, W. A. 1887.2.

Acc'ts of fights with whales. Lütken, C. F. 1877.3; Maclaren, M. 1909.1; Anon. 313. — *Alleged coöperation of fox-shark, Alopias, in these attacks.* Day, F. 1881.2 (p. 55). — *Pre-Linn. refs.* Cooke, E. 1712.1; Hawkins, R. 1622.1; Josselyn, J. 1674.1; N. 1791.1.

Voracious habits of various predatory fishes. The titles of the following papers indicate voracity in the following species.

Voracious habits of the "gar-pike," *Lepidosteus*. Abbott, C. C. 1867.1; Caldwell, E. E. 1913.1; Hussakof, L. 1914.1; Boucher, P. Pre-Linn. 1664.1; Champlain, S. Pre-Linn. 1632.1; Charlevoix, P. F. Pre-Linn. 1744.1.

Voracity in the true pike and pickerel (Esox and Lucius). Abbott, C. C. 1876.2; Corbin, G. B. 1873.1; E., W. W. 1874.1; Hagenow, K. F. 1860.1; Hintze, A. 1894.2; Stirling, A. B. 1863.1; Wagner, C. 1880.1; Canestrini, R. Add. 1886.1; Arnault de Nobleville, L. D. Pre-Linn. 1756.1.

Voracious feeding habits of the "angler," *Lophius*. Blake-Knox, H. 1865.1; Fulton, T. W. 1903.1; Anon. 559; Guitel, F. Add. 1913.1.

Voracity of — Stizostedion. Bean, T. H. 1890.37. — *Belone*. Clogg, S. 1874.2. — *Bdellostoma*. Delfin, F. T. 1900.3.

Probable predatory habits of Palæoniscidæ. Traquair, R. H. 1879.1.

"RAINS OF FISHES"

Comprising accounts of fishes which, after being taken up in waterspouts, are transported to some distance and come down with the rain.

Records of occurrences throughout the world. August, —. 1841.1; Baird, S. F. 1873.3; Buchenau, F. 1873.1; Castelnau, F. L. 1861.2,3; Dekay, J. E. 1842.2; Harting, P. 1861.2; Hubbard, O. P. 1859.1; Landois, H. 1896.1; Muse, J. E. 1829.1; Sharpe, W. 1875.1; Sykes, —. 1840.1; Tennent, J. E. 1861.1; Anon. 226, 227; Arnot, —. Add. 1826.1; Baker, T. R. Add. 1893.1; Boll, E. F. Add. 1858.1, 1868.1; Eglini, R. Add. 1771.1; Gardner, J. W. Add. 1902.1; Harriott, J. Add. 1809.1; P[rinsep], J. Add. 1833.1; Rees, A. Add. 1819.1; S., —. Add. 1834.1; Smith, C. Add. 1826.1; Symson, A. Add. 1823.1; Thompson, D. P. Add. 1849.1; Tomlinson, C. Add. 1865.1; Athenæus, N. Pre-Linn. 1680.1; Conny, R. Pre-Linn. 1698.1.

For a popular account, containing reprints of all original records of "Rains of fishes" with a complete bibliography, see ★E. W. Gudger in *Natural History* (Journ. Amer. Mus.), 1921, vol. **xxi**, no. 6, pp. 607–619.

REGENERATION

The reproduction or regrowth of parts which have been lost or destroyed.

For a closely related subject, see *Teratology*.

General treatises. ★Morgan, T. H. 1901.1, 1907.1; Przibram, H. 1909.1.

Miscellaneous papers. Broussonet, P. M. 1786.1; Eismond, O. P. 1910.1, 1912.1; Nusbaum, J. 1903.1, 1907.3; Scott, G. G. 1909.1.

Heteromorphosis in regeneration. Nusbaum, J. 1903.2. — *Mechanism of regeneration*. Tornier, G. 1906.1.

On regeneration in vertebrate embryos including those of fishes. Barfurth, D. Add. 1903.1.

Regeneration of various parts of the body

Regeneration of numerous parts, such as the fins, operculum, scales, etc., in — Amphioxus. Biberhofer, R. 1906.1. — *Fundulus*. Morrill, C. V. 1906.1. — *Salmo*. Nusbaum, J. & Sidoriak, S. 1900.1.

Regeneration of barbels in Siluroids. Beigel, C. 1912.1; Roth, W. 1905.2.

Regeneration of fins generally. Beigel, C. 1910.1; Bogacki, K. 1906.1; Lachmann, H. 1891.1; Philipeaux, J. M. 1869.1; Scott, G. G. 1907.1, 1909.1,2; Suvorov, E. K. 1904.1.

Nerve formation in transplanted fin anlagen. Braus, H. 1905.1.

Regeneration of caudal fins. Bert, P. 1863.1; Clarke, F. W. 1874.1; Duncker, G. (*Syngnathidæ*) 1905.1; Mazza, F. 1890.2; Scott, G. G. 1909.2.

Regeneration of tail. — General researches. ★Morgan, T. H. 1900.1, 1902.1. — *Caudal region, Pleuronectes*. Boulenger, G. A. 1908.5. — *Protopterus*. Léger, L. 1897.1; Traquair, R. H. 1871.4. — *Petromyzon*. Studnička, F. K. 1912.3.

Regeneration of various other portions of the body. — Operculum and skin. Beigel, C. 1910.1, 1911.1. — *Crystalline lens in teleosts*. Grochmalicki, J. 1908.1,2,3. — *Nerves*. Kolster, R. 1899.1. — *Blood vessels*. Minervini, R. 1911.1. — *Scales*. Ryder, J. A. 1884.4; Scott, W. 1911.1. — *Muscle fibers (striated)*. Schmincke, A. 1907.1.

REPRODUCTION

Comprising *Breeding habits, and general reproductive behavior*.

For the extensive literature on the breeding habits and related activities of *Anguilla*, *Pleuronectidæ*, and *Salmonidæ*, see under these headings in the *Systematic* section.

For the morphology of the Reproductive organs, Ovary, and Testis, see under *Urogenital system*. For the reproductive elements, see *Ova and Ovum, and Spermatozoa*.

For related subjects, see *Embryology*; *Hermaphroditism*; *Hybrids*; *Migration*; etc.

Miscellaneous references. Au, W. 1912.1; Beard, J. 1897.2; Bertrand, Em. 1893.1; Carbonnier, P. 1881.1,2; Cavolini, F. 1787.1, 1792.1, 1808.1; Coste, P. 1858.1; Day, F. 1886.3; Ehrenbaum, E. 1908.1; Emeljanenko, P. E. 1908.1; Langguth, G. A. 1777.1, 1780.1; Lebert, H. 1845.1; Merk, M. 1911.1; Nikitin, S. 1889.1; Richardson, R. E. 1913.1,2; Ritgen, F. A. 1820.1; Schreitmüller, W. 1910.10; Sivard de Beaulieu, G. 1851.1, 1852.1; Holzfuss, E. Add. 1914.2.

Early views, references in Pre-Linn. section. Balduin, G. 1667.1; Fabricius, d'A., J. 1621.1; Gleditsch, J. 1756.1,2; Leeuwenhoek, A. 1691.1–1702.1.

BREEDING HABITS

Comprising only the general unspecified breeding habits. For specific breeding habits see below in this section.

Breeding habits may also be looked for under the heading *Natural History* under the fish in the *Systematic* section.

Reproduction — Cont'd.

CYCLOSTOMATA

Breeding habits of Petromyzon. Frauen, M. 1879.1; Gage, S. H. 1911.1; Loman, J. C. 1910.1; Vieira, L. 1894.5.

DIPNOI

Breeding habits of Protopterus. Budgett, J. S. 1900.2, 5, 1907.1. — *Lepidosiren.* Kerr, J. G. 1897.1, 1900.1. — *Ceratodus.* Semon, R. 1893.1, 1899.1, 1903.1.

ELASMOBRANCHII

The highly specialized breeding habits of Elasmobranchii will be found below under Copulation, Oviparity, and Viviparity.

GANOIDEI

Breeding habits of Acipenser. Dean, B. 1895.3. — *Amia.* ★Dean, B. 1895.2, 1896.5, 1899.4; ★Reighard, J. E. 1900.1, 1901.2, 1902.1, 1904.2, Add. 1902.1. — *Lepidosteus.* Dean, B. 1895.3.

TELEOSTEI

The highly specialized breeding habits of various Teleosts will be found below under Parental Care and Viviparity.

Breeding habits of freshwater fishes of the state of Illinois. Richardson, R. E. 1912.1, 2.

For further like observations on Illinois fishes, see T. L. Hankinson in Trans. Illinois Acad. Sci., 1919, vol. 12, pp. 132-150.

Sub-order Acanthopterygii

Breeding habits of — Cichlasoma. Borchartt, F. 1913.1. — *Cyclogaster.* Ehrenbaum, E. 1897.1 (iii). — *Kreffti.* Gale, A. 1914.1. — *Betta.* Leonhardt, E. E. 1905.5; Waite, E. R. 1904.2; Fabre-Domergue, P. Add. 1914.1. — *Labyrinthici.* Mandée, R. 1907.1. — *Perca flavescens.* Mather, F. 1892.1. — *Etheostoma.* Reeves, C. D. 1907.1. — *Percina caprodes.* Reighard, J. E. 1913.1. — *Heros.* Tappan, F. L. 1912.1.

Sub-order Haplomi

Breeding habits of — Umbra. Abbott, C. C. 1874.3; Carbonnier, P. 1874.1; Gill, T. N. 1906.2. — *Haplochilus.* Gruber, A. 1911.1.

Sub-order Malacopterygii

Breeding habits of — Gymnarchus. Budgett, J. S. 1900.2. — *Clupea.* Derschau, W. 1894.1. — *Lucioperca.* Heide, E. J. 1912.2. — *Shad.* Kirtland, F. 1879.1. — *Coregonus.* Maier, H. N. 1910.1. — *Arapaima.* Marcoy, P. 1869.1; Verissimo, J. Add. 1895.1.

Sub-order Ostariophysi

Breeding habits of — Parasilurus, the Glanis of Aristotle. Agassiz, J. L. 1856.2; Gill, T. N. 1906.4. — *Malopterurus.* Babukhin, A. I. 1875.1, 1877.1; Bilharz, T. 1853.1; Du Bois Reymond, E. H. 1881.2; Fritsch, G. T. 1887.1. — *Rasbora.* Bonorden, A. 1911.1, 1913.1. — *Catostomus.* Culbertson, G. 1904.1.

— *Cobitis, Leucaspis, and Phoxinus.* Knauthe, K. 1890.1. — *Callichthys.* Liebig, T. 1912.1; Schubert, H. 1907.1. — *Leuciscus.* Milewski, A. 1915.2; Schreitmüller, W. 1912.5. — *Ictiobus (Buffalo fish).* Mosher, A. A. 1885.2. — *Semotilus.* Reighard, J. E. 1910.1. — *Leucaspis.* Tautz, A. 1910.1.

Sub-order Percosoces

Breeding habits of — Mugil. Künstler, J. 1904.1. — *Tylosurus.* Abbott, C. C. Add. 1888.1.

Breeding seasons. *Marine fishes.* — *British fishes.* Brook, G. 1885.7. — *North Sea.* Ehrenbaum, E. 1908.2, 1910.1. — *San Diego, Cal.* Eigenmann, C. H. 1891.5. — *Gulf of Naples.* Lo Bianco, S. 1888.1. — *French fishes.* Sauvage, H. E. 1891.2. — *Woods Hole, Mass.* Bumpus, H. C. 1898.1, 2, 3, 1899.1; Sumner, B. F., Osburn, R. C., & Cole, L. J. 1913.1; Thompson, M. T. 1899.1.

Fresh-water fishes of France. Coste, J. J. 1869.1; Guillaume, C. E. 1905.1. — *Of Germany.* Vogt, C. C. 1860.1. — *Comparison of times in standing and running water.* Huet, P. 1906.1. — *Thames R. seasons.* Griffiths, R. Pre-Linn. 1746.1.

Breeding seasons of various fishes. — *Polyodon.* Allen, W. F. 1911.1. — *Cod.* Baird, S. F. 1875.28. — *Variations in Labridæ.* List, J. H. 1887.2. — *Coregonus.* Lochner von Hüttenbach, — 1907.1; Sandman, J. A. 1904.2. — *Black bass.* Wilmot, S. 1876.2.

Copulation. *For actual copulation in teleosts with internal fertilization, Chimæroids, and sharks and rays including oviparous forms, see below under Viviparity.*

Fecundity, or number of eggs produced. *Miscellaneous papers.* Atkins, C. G. 1870.1; Audigé, J. & Loup, — 1909.1; Harmer, T. 1768.1.

Marine fishes, chiefly Gadus morrhua, G. pollachius, Platessa vulgaris, and Pleuronectes platessa. Dunn, M. 1884.2; Earll, R. E. 1880.1; Feldt, — 1899.1; Franz, V. 1910.1, 2; Fulton, T. W. 1906.2; Hensen, V. 1883.1, 1884.1; Hensen, V., & Apstein, C. 1897.1; Laurie, R. D. 1904.1; Reibisch, J. 1899.1.

Fecundity of various other fishes. — *Labrax.* Blanding, W. 1841.1. — *Clupea.* Fulton, T. W. 1904.1; Anon. 458. — *Carp.* Staff, F. 1910.1; Zur Mühlen, M. 1911.17. — *Anguilla* (9,000,000 eggs). Anon. 4. — *Salmon.* Anon. 205.

Methods of estimating number of ovarian ova. ★Fulton, T. W. 1891.4; Reibisch, J. 1899.1. — *For counting of eggs in fish-cultural practises, see Apparatus and appliances, under Pisciculture.*

Pseudo-copulation of oviparous fishes. *Siluroids.* — *Silurus glanis.* Agassiz, J. L. 1856.2. — *Callichthys.* Boecker, W. 1909.1; Carbonnier, P. 1880.2, 3, 1881.2; Eggeling, O., & Ehrenberg, F. 1908.1; Jurgens, W. 1906.1; Vipian, J. A. 1886.1. — *Arius, Auchenipterus, and Os-*

teogeniosus. Day, F. 1875.1; Steindachner, F. 1874.3, 1876.3; Thomas, H. S. 1881.1.

Pseudo-copulation in Callionymus lyra. Holt, E. W. 1898.3; Kent, W. S. 1883.1. — *Cottus gobio*. Surbeck, G. 1900.1, 2.

For *pseudo-copulation of Syngnathidae* at time of egg transferral, see Brood-pouch incubation, below under Parental care.

For actual copulation in viviparous forms, see Viviparity, below.

Sexual maturity. Relation to age and size in marine fishes. Calderwood, W. L. 1892.6; Cunningham, J. T. 1891.7; Fulton, T. W. 1892.2; Holt, E. W. 1892.3, 1893.2.

State of maturity in French fishes. Gourié, E. 1894.3, 1897.1; Sauvage, H. E. 1893.1; Arnoux, E. Add. 1889.1.

For sexual maturity in Eels, see Sexes of eels under *Anguilla* in Systematic section.

Spawning and spawning habits of various fishes

Including courtship and other kinds of spawning behavior, oviposition, etc.

Courtship (*Liebespiel*) of animals including fishes. Marx, A. 1914.1; Pycraft, W. P. 1913.1.

Miscellaneous and general. Björkman, — 1785.1; Canu, E. 1893.2; Damas, D. 1909.2; Dunn, M. 1884.3; Epton, J. 1883.1; Masterman, A. T. 1896.1, 1897.3; Rusconi, M. 1836.1; Schreitmüller, W. 1910.10; ★Strodtmann, S. 1906.1; Coupin, H. Add. 1913.1.

Oviposition of *Amphioxus*, a cephalochordate. Marshall, A. M. 1876.1.

CYCLOSTOMATA

Spawning behavior of *Petromyzon*. Dean, B. & Sumner, F. B. 1897.1; Vejdovský, F. 1893.1. — *Bdellostoma*. Doflein, F. J. 1899.3. — *Lampetra*. Reighard, J. E. 1903.1. — *Brook and lake lampreys*. Gage, S. H. 1893.2.

GANOIDEI

Spawning of — *Acipenser*. Aleksandrov, K. P. 1909.1, 1910.1; Dean, B. 1893.3; Stone, L. 1901.1. — *Lepidosteus*. Locke, W. M. 1879.1.

SELACHII

Oviposition of shelled eggs of *Scyllium canicula* and *catulus*. Bolau, C. C. 1879.1, 1881.1; Coste, J. J. 1867.1; Dambeck, K. 1877.2; Kopsch, F. 1897.1; Meyer, R. 1872.1. — *Chiloscyllium*. Raj, B. S. 1914.1. — *Parascyllium*. Waite, E. R. 1908.1.

See also Oviparity of Elasmobranchii in this section, and Egg-cases of Elasmobranchii under Ova and Ovum.

TELEOSTEI

For the spawning of *Anguilla* and Salmonidae in connection with their migratory habits, see these fishes in the Systematic section.

Sub-order Acanthopterygii

Spawning of — *Perch*. Bean, B. A. 1890.4. — *Sole (Solea)*. Butler, G. W. 1895.1. — *Pleuronectes*. Fulton, T. W. 1904.7, 1906.2; Herdman, W. A. 1903.4; Storrow, B. 1911.1; Trybom, F. 1903.3; Wahlberg, V. 1901.1. — *Eleotris*. Lehmann, A. 1911.1. — *Trigla*. McIntosh, W. C. 1899.1, 1900.2. — *Bluefish (Pomatomus)*. Pierce, H. D. 1883.1, 1884.1. — *Badis*. Pittrich, B. 1907.1. — *Macropode*. Schäfer, P. 1915.3. — *Heterogramma*. Schütz, R. 1912.2. — *Ambassis*. Träber-Klotzsche, G. 1910.1. — *Betta*. Unterberg, J. 1913.1. — *Crenilabrus* and *Labrax*. Eisig, H. Add. 1884.2.

Sub-order Anacanthini

Spawning of — *Gadus (Cod)*. Ewart, J. C. & Brook, G. 1885.1; Fulton, T. W. 1904.4, 1905.2; Meek, A. 1911.1; Sars, G. O. 1876.1; V. 1905.1; Wahlberg, V. 1901.1. — *Lota*. Levander, G. V. 1903.1. — *Whiting*. Storrow, B. 1913.1. — *Merluccius*. McIntosh, W. C. Add. 1912.1.

Sub-order Haplomi

Spawning behavior of — *Haplochilus*. Liebig, T. 1912.6. — *Esox*. Walke, E. H. 1883.1; Brook, G. Add. 1887.2; Argillander, A. Pre-Linn. 1753.1, 2. — *Lebistes*. Wind, A. 1915.1.

Sub-order Malacopterygii

Spawning of — *Herring*. Baird, S. F. 1871.40; Ewart, J. C. 1884.3; Kupffer, C. W. 1876.2, 1878.2; Buch, S. A. Add. 1885.1. — *Sardine*. Launette, P. 1888.1. — *Coregonus*. Lebedintsev, A. A. & Eglit, P. I. 1907.1–1909.1. — *Pantodon*. Siegl, H. 1914.2; Steche, O. 1915.1. — *Alosa (Shad)*. Worth, S. G. 1893.1; Yarrow, H. C. 1874.2. — *Mallotus spawning in sand of seashore*. Anon. 512.

Sub-order Ostariophysii

Spawning of — *Corydoras*. Liebig, T. 1912.5; Wittig, F. 1913.1. — *Danio*. Potempa, A. 1910.2. — *Cyprinidae*. Reighard, J. E. 1904.1, 1910.1. — *Chub (Mylocheilus)*. S., C. A. 1880.1. — *Gobio*. Scholz, E. J. R. 1911.2. — *Carassius*. Schreitmüller, W. 1910.15. — *Chrosomus*. Smith, B. G. 1908.1. — *Cobitis* and *Phoxinus*. Thumm, J. 1905.2.

Spawning of fishes of various other sub-orders

Spawning of — *Lophius*. Baird, S. F. 1871.41. — *Ammodytes*. Fullarton, J. H. 1894.1; McIntosh, W. C. 1897.1. — *Pterophryne*. Gudger, E. W. 1905.2. — *Entelurus æquoreus* (eggs extruded in two bands). Guitel, F. 1908.2. — *Gasterosteus leiurus*. Kinahan, J. R. 1854.1, 2. — *Exocoetus*. Saunders, H. 1874.1.

Spawning Grounds of North Sea; relation of marine currents. Fulton, T. W. 1890.7, 1895.3, 1897.1, 1900.1, 1913.1.

Spawning grounds of various fishes. — *Clupea* in Kaiser Wilhelm Canal. Barfod, H. 1902.3; Hinkelmann, A. 1902.2. — *Breeding grounds of Herring*.

Reproduction — Cont'd.

Petersen, C. G. J. 1901.2. — *Ammodytes*.
Bowman, A. 1914.1. — *Gadus* in North
Sea. Giard, A. & Cépède, C. 1907.1;
Schmidt, E. J. 1909.1. — *Spawning re-
lationships and places, Gadus*. Anon. 327.

PARENTAL CARE**Of eggs and young**

Miscellaneous and general. Belle, —
1910.2; Brandes, G. 1893.2; Brüning, C.
1903.1; Cobb, J. N. 1908.3; Coupin, H.
1901.1; ★Gill, T. N. 1906.3; Krause, E.,
& Sterne, C. 1902.1; Laloy, L. 1901.1;
Leonhardt, E. E. 1905.6; Rozynski, P.
1909.2; Schreitmüller, W. 1910.10;
Werner, Franz. 1900.1; ★Wiedersheim,
R. E. 1900.1, 1901.1; Anon. 358, 510;
Allen, G. Add. 1890.1.

Attachment of eggs to body of parent

Abdominal attachment, by threads
in *Haplochilus melanostigma*. Jenkins, J.
T. 1910.1. — in *H. latipes*. Leonhardt,
E. E. 1905.12.

Frontal attachment by threads to pro-
tuberance of head in *Kurtus gulliveri*.
Guitel, F. 1913.1; Weber, M. C. 1910.1,
.2, 1913.3; Zur Mühlen, M. 1911.8.

Ventral attachment, in cup-shaped
depressions in *Aspredo*. Günther, A.
1880.4, 1886.2; Vaillant, L. L. 1898.4;
Wyman, J. 1859.4.

Ventral attachment in Nerophis, (*Syn-
gnathidae*). Andrews, W. 1854.1, 1860.1;
Carolini, F. 1787.1–1808.1; Ekström, C.
U. 1830.1, 1835.1; Fries, B. F. 1837.2;
Krohn, A. D. 1840.1; Lilljeborg, W.
1884.1; Quatrefages, J. 1842.1.

**Brood-pouch incubation in
Lophobranchii**

Sub-caudal pouch in Syngnathidae.
Males of Hippocampus and Syngnathus.
Andrews, W. 1854.2, 1860.1; Becker, L.
1857.1; Cohn, L. 1903.1; ★Huot, A.
1902.1; Kolster, R. 1907.2; Krohn, A.
D. 1840.1; Krøyer, H. N. 1853.1; Lock-
wood, S. 1868.1, .2, 1887.1; Siebold, C. T.
1842.1; Yarrell, W. 1834.1, 1835.2, .3;
Anon. 473.

*Breeding habits, comprising courtship and
transferral of eggs to marsupium.* Bloch,
M. E. 1782.1; Bonnaterre, P. 1788.1;
Buchanan, F. 1822.1; Canestrini, G.
1871.1, .2; Cuvier, G. 1836.1; Dufossé,
A. 1874.2; Duncker, G. 1900.1; Ek-
ström, C. U. 1830.1, 1835.1; Fanzago, F.
1874.1; Fusari, R. 1895.1; ★Gudger, E.
W. 1905.1; Jacobi, A. 1906.1; Heincke,
F. 1880.1; Lafont, A. 1868.1, Add. 1871.1;
Lilljeborg, W. 1884.1; Marcusen, J.
1873.1; Petersen, M. 1906.1; Rathke, H.
1837.1; Smitt, F. A. 1893.1; Storer, D.
H. 1855.1; Yarrell, W. 1835.2, .3, 1834.1.
— *Review of Gudger*, 1905.1. Lydekker,
R. Add. 1906.4.

*For ventral attachment of eggs without a
brood pouch in Nerophis, see above.*

Ventral fin pouch of Solenostomidae,
*formed by coalescence of ventral fins to body
in females.* Günther, A. 1880.4, 1886.2.
Willey, A. 1909.2.

Incubation in gill-cavities of mussels

*Bitterling (Rhodeus amarus) breeding in
gill-cavities of Anodonta and Unio.* Bach,
M. 1871.1; Bade, E. 1899.7; Braun, P.
1901.1; Cuénot, L. 1898.1; Maslowsky,
A. 1863.1; Mettenheimer, C. 1869.1;
Nölke, — & Hagermann, — 1910.1; Noll,
F. C. 1869.1, 1870.1, 1877.1; ★Olt, A.
1893.1; Pagenstecher, H. A. 1869.1;
Weismann, A. 1876.1. — *Oviducal tube,
structure.* Krauss, F. 1858.1; Leydig, F.
1892.4.

*For association of other fishes and mol-
luscs, see Commensalism.*

Nest-building or Nidification

Miscellaneous and general. Agassiz, J.
L. 1856.2; Bach, M. 1871.1; Couch, R.
Q. 1844.2; ★Ehrenbaum, E. 1897.1
(iii); Figuier, G. L. 1858.1; Gill, T. N.
1907.5; Hardy, J. 1845.1; Harting, P.
1875.1; Lengyel, I. 1872.1; Martens, E.
1872.1; Mitchell, R. W. 1875.1; Peneau,
J. 1913.1; Putnam, F. W. 1859.2; Sur-
beck, G. 1908.5, .6; Anon. 225, 382, 397;
Holder, C. F. Add. 1883.1; Wood, J. G.
Add. 1867.1.

Bird-nest type of nest. *Fixed nest of
stickleback (Gasterosteus).* Bade, E.
1899.10; ★Coste, P. 1846.1, .2, .3; Couch,
R. Q. 1864.3; Dollfus, E. 1871.1; ★Ehren-
baum, E. 1897.1 (iii); Evers, M. 1878.1,
1879.1, 1880.1; Glaser, L. 1865.1; Han-
cock, A. 1852.1; Horsfall, J. H. 1864.1;
Houghton, W. 1865.1; Johnston, G.
1834.4; Jones, J. E. 1871.1; Kinahan, J.
R. 1854.1, .2; Landois, H. 1871.2; Lauppe,
L. 1904.1; Möbius, K. A. 1893.1; ★Prince,
E. E. 1885.2; Putnam, F. W. 1859.2;
R., G. P. 1866.1; Ransom, W. H. 1865.1;
Reitmayer, C. A. 1916.1; Ryder, J. A.
1882.6; Schlesinger, F. W. 1900.1, 1902.1;
Wichand, B. 1904.1; Anon. 290, 381,
522, 523; Braun, M. Add. 1890.1; War-
rington, R. Add. 1852.1. — *Mucous threads
of nest derived from kidney secretions of
male.* ★Möbius, K. A. 1885.1, 1886.1.

*Floating nests of vegetation with attached
eggs.* — *Of Gymnarchus niloticus.* Bud-
gett, J. S. 1900.5, 1907.1. — *Labrus.*
Gerbe, Z. 1864.1. — *Ophiocephalus striatus.*
Willey, A. 1909.1.

Bubble or foam nests. *Nests of Os-
phromenidae of foam strengthened by buccal
secretions.* Bangerter, H. 1914.1; Car-
bonnier, P. 1876.1, .2; Emeljanenko, P.
E. 1909.2; Engmann, P. 1909.1; Eyrich,
L. 1870.1; Gilbert, C. H. 1894.1; Hart-
ing, P. 1877.3; Köhler, W. 1908.1; Leon-
hardt, E. E. 1905.5; Lydekker, R. 1905.1;
Meier, H. 1877.1, 1878.1; Melnikov, V. S.
1902.2, 1903.1; Pobowski, E. 1880.1;
Roth, W. 1909.1; Schreitmüller, W.
1909.4, 1910.18; Treschow, A. 1908.1;
Waite, E. R. 1904.2, 1905.1; Anon. 299,
380.

Foam nest of African characin, Sarco-
daces. Budgett, J. S. 1900.5, 7.

Excavated nests. *Formed by excavation of depressions in the mud, sand or gravel of the bottom.* — *Ameiurus.* Agassiz, J. L. 1856.2; Eycleshymer, A. 1901.1; Girard, C. F. 1854.4; Ryder, J. A. 1883.3; Smith, H. M., & Harron, L. G. 1904.1; Smith, H. M. Add. 1903.1.

Amia calva. Dean, B. 1895.2, 1899.4; Franklin, D. 1914.2; Fülleborn, F. 1894.1; Hallock, C. 1877.1; Maison, E. 1897.1, 2; ★Reighard, J. 1900.1, 1901.2, 1902.1, 1904.2; Whitman, C. O. & Eycleshymer, A. C. 1897.1.

Brook lamprey (Lampetra). Dean, B., & Sumner, F. 1897.1; Gage, S. 1893.2; Reighard, J. E. 1903.1; Young, R. T., & Cole, L. J. 1900.1. — *Sea lamprey (Petromyzon).* Hussakof, L. 1912.6, 1913.3; Wyman, J. 1844.2.

Centrarchidæ. Eupomotis. Agassiz, J. L. 1856.2; Franklin, D. 1914.1; Gill, T. N. Add. 1889.1. — *Micropterus (black bass).* Baird, S. F. 1873.17; Eoff, J. 1855.1; Gill, T. N. 1889.3; Holt, C. F. 1889.1; Lambkin, J. B. 1901.1, 1903.1; Lydell, D. 1903.1–1904.1; ★Reighard, J. E. 1906.1.

Various other fishes. — *West African fishes, Heterotis, Hyperopisus, Protopterus.* Budgett, J. S. 1900.5, 1907.1. — *Rhinichthys atronatus.* Gregg, W. H. 1879.1. — *Doras.* Hancock, J. 1828.2. — *Lepidosiren.* Kerr, J. G. 1900.1. — *Semotilus atromaculatus.* Reighard, J. E. 1910.1. — *Arius australis.* Semon, R. 1896.2, 1899.1, 1903.1. — *Callichthys.* Vipan, J. 1886.1. — *Semotilus corporalis, stone heaps in Ottawa River.* Wilson, A. W. 1907.1; Bell, R. Add. 1897.1.

Pelagic "nests," composed of gelatinous bands with imbedded eggs, generally entangled in sea-weed. — *Of Kelpfish (Heterostichus).* Holder, C. F. 1907.1.

Nests of Antennariidæ, Antennarius or Chironectes, drifting among Sargassum weed. ★Agassiz, J. 1872.1, 1873.2; Baird, S. F. 1871.41, 1872.2; Geare, R. I. 1903.2; Goode, G. B. 1876.2; Gudger, E. W. 1905.2; Hinde, G. J. 1872.1; Jones, J. M. 1872.1; Martens, E. 1872.1; ★Möbius, K. A. 1894.1; Thomson, C. W. 1877.1; ★Vaillant, L. L. 1887.3; Jones, S. G. Add. 1884.1. — *Not a nest-maker.* Gill, T. N. 1905.13, 1907.7.

For description of floating "rafts" of eggs of Lophius and other types of Pelagic ova, see under Planktonic fauna.

Unformed "nests," being merely selection of sheltered sites with egg deposition and subsequent guarding by the adult fish.

Blennies. — *Blennius.* Cunningham, J. T. 1889.4; Guitel, F. 1893.2, 3; Pieron, H. 1914.1. — *Pholis gunnellus.* Ehrenbaum, E. 1897.1 (iii); Holt, E. W. 1893.4; McIntosh, W. & Prince, E. 1890.1. — *Clinus argentatus.* Guitel, F. 1892.2, 1893.2.

Cottus (Miller's Thumb). Ehrenbaum, E. 1897.1 (iii); Gill, T. N. 1905.15, 1908.2; LeDanois, E. 1911.1; McIntosh, W. C. 1897.1; Meek, A. 1915.5; Peek, R. 1869.1; Peck, T. Add. 1869.1.

Cyclopterus (Lumpfish). Bonnaterre, P. 1788.1; Ehrenbaum, E. 1897.1 (iii); Fulton, T. W. 1906.3; Gill, T. N. 1907.3; McIntosh, W. C. 1886.4, 1897.1.

Gobius. Filippi, F. 1841.1, 2; Guitel, F. 1892.1, 1895.1; Holt, E. W. 1890.3; Petersen, C. G. 1891.3, Add. 1892.1; Saint-Joseph, — 1881.1, 1893.1.

Lepadogaster. Guitel, F. 1888.1, 1890.6; McIntosh, W. C. 1897.1; Smith, W. A. Add. 1885.1.

Toadfishes, Opsanus and Porichthys. Gill, T. N. 1907.2; Greene, C. W. 1899.1; ★Gudger, E. W. 1910.1; Ryder, J. A. 1886.3; Storer, D. H. 1855.1.

Oral gestation

Miscellaneous and general. Boettger, D. 1902.1; Gill, T. N. 1906.3; Gudger, E. W. 1909.1; Hutchinson, R. F. 1880.1; Newman, E. 1860.3; ★Pellegrin, J. 1904.2, 1907.2, Add. 1907.1; Potempa, A. 1909.1; ★Anon. 677, 683; Boulenger, G. A. Add. 1902.1, 2, 1909.2; Sachs, E. T. Add. 1881.1.

Alleged oral gestation (*Considered doubtful or already disproved.*) — *In Amia calva.* Reighard, J. 1904.2; Whitman, C. O., & Eycleshymer, A. C. 1897.1; Estes, D. C. Add. 1887.1. — *Malopterurus.* Babukhin, A. I. 1875.1, 1877.1; Boulenger, G. A. 1901.22, 1907.15; Fritsch, G. T. 1887.1. — *Loricaria.* Agassiz, J. L. 1868.1; Ihering, H. 1893.2; Regan, C. T. 1904.6. — *Gymnotus electricus.* Du Bois-Reymond, E. H. 1882.2; Sachs, C. 1881.1; Spix, J. B., & Martius, C. F. 1823.1. — *Betta pugnax.* Hipler, J. 1913.1, 2. — *Various Brazilian fishes.* Monteiro de Noronha, J. Add. 1841.1.

Chilodipterinæ. (*Serranidæ*), *Apogon (Amia).* Kendall, W. C., & Radcliffe, L. 1912.1; Radcliffe, L. 1911.1, 1912.1; Regan, C. T. 1902.2; Vaillant, L. 1903.1; Steindachner, F. & Döderlein, L. 1883.1; Weber, M. 1913.1; Boulenger, G. A. Add. 1902.1; Ogilby, J. D. Add. 1889.1; Smith, H. M. Add. 1910.1; Stead, D. G. Add. 1906.1, 1907.5. — *Archamia.* Evermann, B. W., & Seale, A. 1907.1.

Cichlidæ. *General.* Dreyzehner, — 1909.1; Emeljanenko, P. W. 1910.1; ★Pellegrin, J. 1904.2.

African Cichlidæ of numerous genera. Abraham, N. 1901.1; Boulenger, C. L. 1908.1; Boulenger, G. A. 1898.15, 1899.14, 1900.18, 1901.22, 1906.5, 6, 1907.15, 1908.1, Add. 1909.1, 1902.1; Conrad, — 1908.1; Cornet, J. 1893.1; Engmann, P. 1903.2; Flieszbach, O. 1901.1, 1903.1, Add. 1907.1; Geidies, H. 1912.1; Gruber, A. 1911.2; Günther, A. C. 1901.2; Köhler, W. 1903.1; Moore, J. E. 1902.1; ★Pellegrin, J. 1904.2, 1906.4, 5, 1907.17, 1909.7, 1910.1; ★Schoeller, C. H. 1903.1;

Reproduction — Cont'd.

Schreitmüller, W. 1912.7; Weber, M. 1897.1; Supino, F. Add. 1910.1.

Syrian Cichlidæ of Jordan R. system. Boulenger, G. A. 1898.15; ★Lortet, L. 1875.1, 2, 1883.1; Lubach, D. 1876.1; Pellegrin, J. 1904.2, 1905.2; Masterman, E. W. Add. 1908.1, 1909.1.

South American Cichlidæ, chiefly Geophagus. Agassiz, J. L. 1865.1; ★Agassiz, J. L., & Agassiz, E. 1868.1; Eigenmann, C. H. 1912.2; Engmann, P. 1903.1; Gill, T. N. 1909.3; Harting, P. 1866.3; Hase-man, J. D. 1911.2; Hensel, R. 1870.1; Orton, J. 1870.1; Pellegrin, J. 1904.2; Putnam, F. W. 1865.9, Add. 1863.1; Coutinho, J. M. Add. 1866.1.

Osteoglossidæ. *Arapaima.* Castelnau, F. L. 1855.1; Du Bois-Reymond, E. 1882.2; Ferreira, A. R. 1903.1; Schomburgk, R. H. 1841.1; Spix, J. B., & Martius, C. F. 1823.1; Monteiro de Noronha, J. Add. 1841.1. — *Osteoglossum.* Hase-man, J. D. 1911.2. — *Scleropages.* Fuhrmann, O. 1905.1, 3, 6, 1906.3, Add. 1905.1; Boulenger, G. A. Add. 1909.2, 1911.1.

Siluridæ. *Earliest references to oral gestation in Silurids of unknown habitat.* Bloch, M. E. 1785.1, 2; Bloch, M., & Schneider, J. 1801.1.

African Galeichthys. Boulenger, G. A. 1891.2.

Indian and Ceylon forms. Boake, B. 1866.1; Day, F. 1873.4, 1875.1, 1876.1, 1889.1, Add. 1885.1; Günther, A. 1866.1, 1880.4; Jenkins, J. T. 1910.1; Perrier, E. 1903.1; Thomas, H. S. 1881.1; Turner, W. 1867.1; Willey, A. 1910.1, Add. 1909.1; Boulenger, G. A. Add. 1909.2.

Indo-Australian forms, chiefly Australia and New Guinea. Kampen, P. N. 1910.1; Ramsay, E. P., & Ogilby, J. D. 1886.1; Stead, D. G. 1906.1, 1908.1, Add. 1907.5; Woods, J. E. 1888.1; Albertis, L. M. Add. 1881.1; Boulenger, G. A. Add. 1902.1.

North American marine forms. — Conorynchos nelsoni of Yucatan. Evermann, B. W., & Goldsborough, E. L. 1902.1, 3; Meek, S. E. 1904.1. — *Felichthys felis.* Clarke, S. C. 1884.1, Add. 1883.1; Goode, G. B. 1888.1, 1903.1; Gudger, E. W. 1908.1, 1912.3; Henshall, J. A. 1895.1; Holder, C. F. 1904.1; Jenkins, O. P. 1887.2; Ryder, J. A. 1883.3, 1887.2; see also ★Gudger, E. W. in Pub. 252, Carnegie Instit. Wash., 1918. — *Galeichthys milberti.* Hallock, C. 1877.1; Lupton, N. T. 1877.1–1880.1; Ryder, J. A. 1883.3, 1887.2; Smith, H. M. 1907.1. — *Netuma of Panama.* Gilbert, C. H., & Starks, E. C. 1904.1; Steindachner, F. 1876.3.

South American forms, chiefly from Brazil and British Guiana. Appun, K. F. 1870.1; Castelnau, F. L. 1855.1; Dalton, H. G. 1855.1; Günther, A. 1859.1; Hase-man, J. D. 1911.2; Hensel, R. 1868.1, 1870.1; Ihering, H. 1888.1, 1897.1, Add. 1885.1; Martin, M. 1834.1; Pellegrin,

J. 1907.16, 1908.5; Schomburgk, R. H. 1841.1; Wyman, J. 1859.4, 6; Alexander, J. E. Add. 1832.1; Green, J. Add. 1858.1; Hillhouse, W. Add. 1825.1; Schomburgk, M. R. Add. 1847.1.

Various fishes. *Amblyopsis spelæus.* Eigenmann, C. H. 1900.1, 1909.2. — *Trematomus berrnacchi.* Pellegrin, J. 1904.2. — *Luciocephalus pulcher.* Volz, W. 1904.1. — *Anabas multispinis.* Boulenger, G. A. Add. 1911.1.

OVIPARITY OF ELASMOBRANCHII

Oviparous reproduction by shelled eggs in sharks and rays. — General accounts. ★Müller, J. 1840.1, 1842.3; Tilesius von Tilenau, W. 1802.1.

Oviparity in the following Elasmobranchs including descriptions of their eggs and embryos. — Myliobatis. Couch, J. 1847.2. — *Chimæra.* Dean, B. 1906.1. — *Somniosus.* Lütken, C. F. 1880.2. — *Callorhynchus antarcticus.* Parker, T. J. 1882.5, Add. 1884.2. — *Skates.* Putnam, F. W. 1870.8.

See also Oviposition of shelled eggs of Selachii in this section, and Egg-cases of Elasmobranchii under Ova and Ovum.

OVOVIVIPARITY

Ginglymostoma. Gudger, E. W. 1913.5, Add. 1912.2, 1913.1, 1914.2.

VIVIPARITY

Miscellaneous and general. Adams, A. 1863.1; Agassiz, J. L. 1856.10; Balbiani, E. G. 1886.1; Eigenmann, C. H. 1899.9; Emeljanenko, P. E. 1907.1; Lubach, D. 1866.2; Osburn, R. C. 1912.3; Ringel, E. 1911.1; ★Ryder, J. A. 1886.7; Anon. 332; Sterne, C. Add. 1901.1. — *Pre-Linn. ref.* Grew, N. 1681.1.

Evolution of viviparity, theory based on Characodon. Philippi, E. 1906.2.

Oviducal or uterine gestation of Elasmobranchs

Miscellaneous items. Agassiz, J. L. 1856.7, 8; Batarra, G. 1771.2; Blackford, E. G. 1880.1; Coles, R. J. 1910.1, 1913.1; Gudger, E. W. 1912.2; Lesseps, F. M. 1874.1; Lovejoy, J. F. 1880.1; Mitchill, S. L. 1803.1; Oerley, L. 1885.2, 4; Pearson, J. T. 1835.1; Stearns, S. 1878.1; Flourens, M. J. Add. 1836.1, 1838.1; Geoffroy, C. Pre-Linn. 1721.1. — *First reference.* Aristotle, Pre-Linn. 1476.1.

Presence in Squalus and Spinax, of a prenatal knob on dorsal spine to prevent cutting mother. Ball, R. 1847.1; Koppen, H. 1901.1; Markert, F. 1896.1. — *Parturition in Pristiurus.* Borcèa, J. 1908.1. — *Fat content of Selachian liver during pregnancy.* Polimanti, O. 1912.6. — *Implantation of selachian ovum in spleen.* Gargano, C. Add. 1914.1.

Copulatory organs (Myxopterygia) and their use; including oviparous forms.

Manner of copulation in sharks and rays. Agassiz, J. L. 1858.10, 1871.1; ★Bolau,

C. C. 1881.1; Dambeck, K. 1877.2; Gudger, E. W. 1913.5; Raj, B. S. 1914.1; Robson, C. H. 1884.1; Schneider, A. F. 1883.1.

Fossilized remains of claspers in Ceterhinus and Pleuracanthus. Beneden, P. J. 1876.1,2; Fritsch, A. J. 1890.3, 1895.1. — *Chimæroids.* Woodward, A. S. 1889.2, 1906.3.

Frontal claspers in Chimæroids. Dean, B. 1906.1.

Morphology of the claspers or myxopterygia. Albrecht, P. 1886.2; Bloch, M. E. 1785.4, 1788.1; Costa, O. G. 1861.1; Davidoff, M. 1879.1; Davy, J. 1839.1, 1861.1; Garman, S. 1877.2; ★Gegenbaur, C. 1870.4,5, 1876.1; Gunner, J. E. 1763.1; ★Huber, O. 1901.1,2, 1908.1; ★Jungersen, H. F. 1898.2,3, Add. 1899.1; ★Krall, A. 1908.1; Mayer, A. F. 1834.1, 1842.1; Ostroumov, A. A. (*Phylogeny*) 1893.1; Parker, T. J. 1886.2; ★Petri, K. R. 1878.1; Putnam, F. W., & Garman, S. W. 1874.1; Stannius, F. H. 1840.1; Treviranus, G. R. 1826.1,2; Vogt, C. C., & Pappenheim, S. 1859.1; Haswell, W. A. Add. 1884.1.—*Shown to be copulatory organs.* Agassiz, J. L. 1858.9,10. — *Early ref.* Klein, J. T. Pre-Linn. 1740.1.

"*Gland*" of clasper, anatomy, etc. Home, E. 1809.1, 1810.1, 1813.1; Jungersen, H. E. 1898.2,3, Add. 1899.1; Molin, R. 1853.1, 1859.1; Smith, (Sir) A. 1829.1, 1849.1.

For a recent paper on claspers, gland, etc., see ★Leigh-Sharpe, W. H. in *Journ. Morphology*, 1920, vol. 34, pp. 245-265; 1921, vol. 35, pp. 359-378; 1922, vol. 36, pp. 191-244, ill.

Foetal membranes. *Pseudamnion*, a thin, transparent membrane, the homologue of the horny egg-case of oviparous forms. Evant, T. 1904.1,2; Gudger, E. W. 1912.1. — *Mustelus.* Parker, T. J. 1882.4, 1890.1.

Numerous embryos in a single envelope; Rhinobatus and Trygonorhina. Haacke, J. W. 1885.2, Add. 1886.1. — *Discussion of this.* Jungersen, H. F. 1885.1.

An analysis of the pseudo-amniotic fluid. Liversidge, A. Add. 1890.1.

Nourishment of embryo in Selachii.

Nourishment by means of external gills, acting as placenta. Alcock, A. W. 1890.2, 1892.4; ★Clemens, P. 1895.1; Home, E. 1810.1, 1816.3; Jacobson, L. L. 1834.1; Leuckart, F. S. 1836.1; Lubach, D. 1870.1; Rathke, M. H. 1827.1; Schenk, S. L. 1875.1; Macartney, J. Add. 1818.1; Owen, R. Add. 1833.1.

For the structure and development of the external gills in Selachii, see *False External Gills under Respiratory System.*

Yolk-sac-placenta formation in sharks. Ercolani, G. B. 1879.1; Leydig, F. 1852.1; ★Mehrdorf, C. 1890.1; ★Müller, J. 1842.3.

See also *Yolk Sac and Umbilical Cord, under Embryology.*

Dorsi-ventral expansion of tail of embryo Pteroplatea, probably functioning as

an absorptive surface. Gudger, E. W. 1911.1.

Uterus. Structure. ★Bruch, E. 1860.1. — *Condition before first gestation.* Blaizot, L. 1908.1,2. — *Mucosa, histology.* Brinkmann, M. C. 1903.1. — *Musculus sphincter uterorum.* Widakowich, V. 1907.2, 1908.1. — *Internal structure.* Leydig, F. Add. 1857.1.

Uterine villi or trophonemata, structure, relation to embryo, etc. Gudger, E. W. 1912.2, 1913.3; Lönnberg, A. J. 1902.2; Trois, E. F. 1867.1, 1876.6; Widakowich, V. 1907.1; ★Wood-Mason, J., & Alcock, A. 1891.2, 1892.1; Carus, C., Otto, A., & D'Alton, E. Add. 1828.1.

Viviparity, general accounts. ★Alcock, A. W. 1890.2, 1901.1, 1902.1; Gudger, E. W. 1912.2; Home, E. 1810.1, 1816.3; Mitchell, S. L. 1803.1; ★Müller, J. 1840.1, 1842.1, 1842.3; Müller, J., & Henle, J. 1841.1; Tilesius von Tilenau, W. G. 1802.1.

Figures of embryos of various species. ★Garman, S. 1913.1.

Viviparity in the following sharks and rays, including in some cases descriptions of their intra-uterine embryos.

Sharks

Acanthias. Garman, S. 1913.1; Leidy, J. 1865.1; Leuckart, F. S. 1831.1; Sauvage, H. E. 1888.4; Wyman, J. 1848.1.

Chlamydoselachus. Brohmer, P. 1909.1; Dean, B. 1903.6; Garman, S. 1913.1; Nishikawa, T. 1898.1; Ziegler, H. E. 1908.1.

Galeus. ★Müller, J. 1840.1, 1842.3; Peabody, J. E. 1896.1.

Lamna. Calderwood, W. L. 1887.1; Lohberger, J. 1910.1; Shann, E. W. 1911.1; Swenander, G. 1907.1.

Pristiophorus. Haswell, W. A. 1885.1, Add. 1889.1; Stead, D. G. 1906.2.

Pristis. Hussakof, L. 1912.3; Southwell, T. 1910.2.

Zygæna. Cantor, T. E. 1845.1; Gudger, E. W. 1912.1; Leuckart, F. S. 1836.1; Wyman, J. 1856.4.

Viviparity in — Galeorhinus. Garman, S. 1913.1. — *Scoliodon.* Gudger, E. W. 1915.3. — *Scymnus.* Parker, T. J. 1882.1. — *Carcharodon.* Sanzo, L. 1910.1. — *Oxyrhina.* Vaillant, L. L. 1889.1. — *Squalus.* Zouiev, B. 1787.1. — *Centrina.* Carus, C. G., Otto, A. W. & D'Alton, E. Add. 1828.1.

Rays

Aetobatus. Coles, R. J. 1910.1, 1913.1; Gudger, E. W. 1914.1; Klunzinger, C. B. 1871.1.

Narcacion and Rhina. Garman, S. 1913.1.

Narcine. Bean, B. A. & Weed, A. C. 1911.1; Garman, S. 1913.1.

Pteroplatea. Alcock, A. W. 1892.5. — *Pteroplatea and Dasyatis.* Gudger, E. W. 1910.1, 1911.1, 1912.2, 1913.3.

Reproduction — Cont'd.

Rhinoptera. Bleeker, P. 1852.11; Coles, R. J. 1913.1; Gudger, E. W. 1912.1.

Torpedo. Emmert, J. 1900.1; Leuckart, R. 1850.1.

Trygon. Alcock, A. 1892.4. — *Trygon and Urolophus*. Haswell, W. A. Add. 1889.1.

Ovarian gestation of Teleosts

Alleged viviparity. — *Gadidae*. Agassiz, J. L. 1856.11. — *Arapaima*. Castelnau, F. L. 1855.1. — *Malopterurus*. Fritsch, G. T. 1887.1. — *Rhodeus*. Jeitteles, B. J. 1862.2. — *Cyprinodon*. Lortet, L. 1883.1. — *Fundulus*. Newman, H. H. 1909.2. — *Mola*. Pembroke, — 1872.2. — *Luciocephalus*. Reichelt, J. Add. 1906.1. — *Gymnotus*. Sachs, C. 1881.1. — *Osphromenus*. Hardwicke, T. 1829.1; Reichelt, J. Add. 1906.1; Artaud, J. Add. 1827.1.

Various Siluroids. — *East Indian*. Bleeker, P. 1858.8. — *Galeichthys*. Evermann, B. W., & Bean, B. A. 1896.1. — *Arius*. Thurston, E. 1900.1. — *British Guiana forms*. Appun, K. F. 1870.1; Schomburgk, R. H. 1841.1; Hillhouse, W. Add. 1825.1.

Blenniidae. *Clinus despicillatus*. Rauter, M. 1909.1; Günther, A. 1876.3; Johnston, R. M. Add. 1883.2. — *Unidentified blenny from Australia*. Becker, L. 1857.2.

Comephoridae. *Comephorus baicalensis*. Zograf, N. Y. 1901.2, 1902.2. — *Death after parturition*. Dybowski, B. I. 1873.1, 1901.1.

Cyprinidae. *Barbus viviparus*. Weber, M. 1897.1.

Embiotocidae. Agassiz, J. L. 1853.4, 1854.1; Alzate y Ramirez, J. A. 1772.1, 1773.1; Blake, J. H. 1867.1–1869.1; ★Eigenmann, C. H. 1894.4, 1895.1, 1896.4; Girard, C. F. 1856.7, 1859.1, 1890.2; Jackson, A. C. 1853.1; Lambert, G. 1895.1; Lord, J. K. 1867.5; Mitchell, G. L. 1899.1; Ryder, J. A. 1885.4, 1886.7, 1893.2; Anon. 210, 568. — *Mating habits*. Randolph, P. B. 1898.1. — *Vascular respiratory mechanism of the vertical fins*. Ryder, J. A. 1893.2.

Ophidiidae. *Various genera from the Indian Ocean*. Alcock, A. W. 1891.1, 1895.1, 1898.1, 1901.1.

Poeciliidae. *Miscellaneous and general*. Agassiz, J. L. 1853.6, 9, 1858.5; Dowler, B. 1855.1; Duvernoy, M. 1844.1; Fitzgerald, C. 1872.1; Stansch, K. 1911.6, 1914.1; Wichand, B. 1906.1.

Morphology of intromittent organ (anal fin) of male. Bade, E. 1904.1; Henn, A. W. 1916.1; ★Langer, W. F. 1913.1; Regan, C. T. 1913.18.

The intromittent organ of Anableps possesses a dextral or sinistral structure, presumed by Garman to require mating with an opposite type of female and thus cause cross-fertilization. Garman, S. 1895.1, 2, 1896.1; Martens, E. 1896.2.

Phallostethus, the only known viviparous *Poeciliid* not American, possesses an intromittent organ which is formed from the modified ventral fins. Regan, C. T. 1913.14.

Viviparity in various genera. — *Anableps*. Bloch, M. E. 1785.2; Garman, S. 1895.1, 2, 1896.1; Lacépède, B. G. 1798.1; Ryder, J. A. 1886.7; Wyman, J. 1856.1, 1859.1. — *Characodon*. Philippi, E. 1906.2. — *Cnesterodon*. Brandes, G. 1900.1; Matte, P. 1900.1; ★Philippi, E. 1906.1, 1908.1, 1908.2; Zolotniskii, N. F. 1901.1, 2, 1903.1; Liebe, W. Add. 1914.1. — *Gambusia*. Ryder, J. A. 1882.11, 1886.7, Add. 1884.1; Seal, W. P. 1911.1; Smith, H. M. 1912.5; Stollreither, A. 1914.1; ★Kuntz, A. Add. 1914.2. — *Girardinus*. Boulenger, E. G. 1912.1; Ihering, H. 1883.1; Langner, A. 1910.1; Lorang, C. 1912.2; Perugia, A. 1891.1; Stüve, H. 1901.1. — *Jordanella*. Mayer, A. 1914.1. — *Molliensia*. Schroot, W. 1903.1. — *Xiphophorus*. Weyenbergh, H. 1872.1, 1874.1, 1878.1. — *Zygonectes*. Ryder, J. A. 1881.1.

Duration of pregnancy in Lebistes reticulatus is about one month at 25° C. and more than three months at 18° C. Johs. Schmidt in Journ. of Genetics, 1919, vol. 8, p. 150.

Parturition in various forms. Seal, W. P. 1911.1; Schiche, E. 1915.1; Schulz, F. 1904.1; Strieker, M. 1906.2; Weyenbergh, H. 1878.2; Wind, A. 1915.1.

Scombresocidae. *Hemirhamphus*. Peters, W. C. 1866.2, 4.

Scorpaenidae, chiefly *Sebastes marinus*. Eigenmann, C. H. 1893.3, 1894.5; Ryder, J. A. 1887.4; Williamson, H. C. 1911.4.

Zoarcidae. "*Blenny*," *Zoarces viviparus*. Bambeke, C. 1888.1; Bloch, M. E. 1782.1; Blum, J. 1882.1; McIntosh, W. C. 1885.2; ★Stuhlmann, F. L. 1887.1; Wallace, W. 1903.1; Rathke, M. H. Add. 1833.1. — *Embryonic nutrition*. Kolster, R. 1905.1. *Cuban forms (Brotulidae)*, *Lucifuga* and *Stygicola*. Lane, H. H. 1903.1, 1908.1, 1909.1.

RESPIRATION

For comprehensive general treatises on respiration, see ★Bakák, E. Add. 1912.1; ★Winterstein, H. Add. 1912.1.

Aerial respiration**Air breathing by fishes**

Miscellaneous papers. Allen, G. 1885.1; Harting, P. 1878.3; Oswald, F. 1907.1; Roth, W. 1905.1. — *Necessity in formation of coprolites*. Vaillant, L. L. 1896.6.

By means of air-bladder functioning as a respiratory organ.

Aerial respiration in the lung-fishes or Dipnoi. Dubois, R. 1891.1, 1892.1; Duméril, A. H. 1870.1, 6; ★Oppel, A. Add. 1905.1.

Respiration in Amia calva. Duméril, A. H. 1870.1, 6; Stauffer, J. 1879.2; Wilder, B. G. 1876.2, 1877.1, 1878.1, 3.

Respiratory function of air bladder in Lepidosteus. ★Mark, E. L. 1890.1.

See also under Dipnoi (Ceratodus, Lepidosiren and Protopterus) and Ganoidei, (Amia and Lepidosteus), Natural History.

Aerial respiration in various Teleostei. — *Umbra*. Brimley, C. S. 1896.1; ★Rauther, M. 1914.1. — *Gymnarchus*. Duvernoy, G. L. 1853.1; Erdl, M. P. 1847.2; Förg, — 1853.1. — *Erythrinus and Sudis*. Jobert, C. 1878.1.

Air bladder, as reservoir of oxygen when fish is in stagnant water. Moreau, F. A. 1876.3.

By means of wall of intestine. — *Brazilian Siluridae*. Edwards, H. M. 1878.1; Jobert, C. 1877.1, 1878.1; Brünig, C. Add. 1914.4. — *Monopterus*. Volz, W. 1905.1, 4, 5, 1906.1.

Intestinal respiration in the European loach, Misgurnus (Cobitis). Babák, E. 1907.1, 1914.1; ★Baumert, F. M. 1853.1, 2; Bischof, C. G. 1818.1; Calugareanu, D. 1907.1; Erman, P. 1808.1; Lupu, H. 1910.1; Anon. 67.

By labyrinthiform and accessory respiratory organs of various types.

Various papers, observations, on Indian fishes, etc. Bade, E. 1912.2; Carbonnier, P. 1874.4; ★Day, F. 1868.3, 1877.3; ★Dobson, G. E. 1874.1; Grigorian, C. 1901.1; Harting, P. 1877.2; Semper, C. Add. 1895.1.

For the highly complicated structure of the labyrinthiform organs and related structures, see Accessory branchial organs under Respiratory organs.

Branchial or gill respiration

General treatises on respiration of fishes. Flourens, M. J. 1844.1; Kuiper, T. 1907.1.

Respiration as a factor in locomotion. Brugmans, S. J. 1812.1. — *Relation to phosphorescence.* Pflüger, E. F. 1875.1, 2. — *Alleged importance of water as a respiratory stimulus.* Rynberk, G. A. 1911.1, 2.

Influence of age, temperature and size on respiration. Babák, E. & Hepner, J. 1912.1; Baird, S. F. 1873.35; Polimanti, O. 1912.2; Zuntz, N. 1914.1, 2; Ege, R. & Krogh, A. Add. 1914.1; Gardner, J. A. & Leetham, C. Add. 1914.1.

Miscellaneous accounts of respiration in fishes, unimportant papers, notes, etc. Babák, E. 1911.1, 1912.1; Baird, S. F. 1872.23; Bataillon, E. 1896.1, 2; Bert, P. 1869.2; Bohn, G. 1903.1; Broussonet, P. M. 1785.1; Camus, L. & Nieloux, M. 1903.1; Carradori, G. 1799.1; Duméril, A. M. 1807.1, 2; Frédéricq, L. 1891.1; Galton, J. C. 1871.1; Harting, P. 1870.1, 1873.1; Jobert, C. 1877.2, 1878.2; Loewy, — 1909.1; Lovén, S. L. 1830.1; Osburn, R. C. 1911.5; Quinquand, E. 1873.1; Reuter, F. 1909.1; Richet, C. R. 1880.1; Sacy, A. I. 1791.1; Spallanzani, L. 1803.1; Anon. 65, 551, 552; Camerarius, J. R. Add. 1760.1; Carcani, P. Add. 1791.1; Carradori, G. Add. 1794.1; Duméril, C. Add. 1807.1; Fischer von Waldheim, G. Add. 1801.1; Holzfuss, E. Add. 1914.1; Jolyet, F. Add. 1880.1; Lafont, A. Add. 1868.1; Volta, G. S. Add. 1838.1.

Early papers on respiration, in Pre-Linn. section. Bartholinus, C. 1700.1; Bartholomæus 1647.1; Bernhardt, F. 1656.1; Camerarius, J. R. 1624.1; Eccard 1637.1; Katzbeccius, G. 1609.1; Klein, J. T. 1740.1; Needham, W. 1667.1; Severinus, M. A. 1659.1; Theophrastus 1479.1.

Physiology of respiration, comprising general chemical and physical researches.

For a résumé of the more recent work on the physico-chemical processes involved in respiration, see ★Winterstein, H. Add. 1912.1.

Important technical papers on the physiology of respiration. ★Bounhiol, J. P. 1904.1, 1905.1, 1905.12, 1906.1; Duncan, C. & Hoppe-Seyler, F. 1892.1; Gage, S. H. 1892.1; ★Gréhant, L. F. 1869.1, 1870.1, 1871.1; Jolyet, F. 1879.1, 1880.1; Jolyet, F. & Regnard, P. 1877.1; Montuori, A. 1913.1; Provençal, — & Humboldt, F. 1809.1; Regnard, P. & Blanchard, R. 1883.1; Regnault, V., Reiset, J. & Millon, E. 1848.1; ★Rynberk, G. A. 1905.4, 1906.1; Schoenlein, K. 1895.1; Trendelenburg, P. 1912.1; Winterstein, H. 1908.1; Ishihara, M. Add. 1906.1.

Permeability of branchial membranes to salt solutions, in its relation to respiration. Frédéricq, L. 1901.2; Hyde, I. H. 1908.1, 1909.1; Scott, G. C. & White, G. F. 1910.1; Backman, E. L. Add. 1914.1.

Respiratory mechanism in fishes

For comprehensive treatises on the mechanism of respiration, see ★Baglioni, S. 1907.1, 1908.2; and ★Oppel, A. Add. 1905.1, 1906.1.

General. Duvernoy, G. L. 1839.1, 2; Flourens, M. J. 1830.1; ★Holmquist, O. 1910.1.

Respiratory center, situated in the medulla oblongata. Experiments to determine localization. Babák, E. 1914.1; ★Hyde, I. H. 1904.1; Steiner, J. 1888.1; Vulpian, E. F. 1886.2.

Respiratory mechanism in Petromyzon. Couvreur, E. 1898.1; ★Dawson, Jean 1904.1, 1905.1; Oken, L. 1821.1, 1829.2.

Mechanism in Elasmobranchii. Couvreur, E. (*Torpedo*) 1902.1, 1903.1; Darbishire, A. D. 1907.1; Vaillant, L. L. (*Mobula*) 1912.1.

For respiration of fetal sharks by means of external gills see Nourishment of embryo under Viviparity in section on Reproduction.

Respiratory mechanism in Teleostei. Kuiper, T. 1906.1. — *Blenniidae and Pholis*. Kneeland, S. 1862.1. — *Syngnathus*. Lichtenstein, M. H. 1836.1. — *Mugil*. Molin, R. 1853.3. — *Ammodytes*. Pieri, J. B. 1896.1. — *Carassius*. Westerlund, A. 1906.1.

Vascular respiratory mechanism of the vertical fins of embryonic Embiotocidae. Ryder, J. A. 1893.2.

Respiratory movement of the branchial apparatus. For a comprehensive review of the literature of this subject see ★Baglioni, S. 1910.2.

Respiration—Cont'd.

General papers. Babák, E. & Dedek, B. 1907.1, 1908.1; Bjeloooussow, N. 1901.1; McKendrick, J. G. 1879.1; Mines, G. R. 1913.2; Varigny, H. C. 1892.1.

Technical researches. — *Synchronism of respiratory movements with heart rhythm in embryos.* Babák, E. & Hepner, J. 1912.1. — *Nervous regulation of respiratory rhythm.* Deganello, U. 1907.1–1908.1. — *Theory of origin of respiratory movements.* Lombroso, U. 1907.1–1908.2; Anon. 582.

"Yawning," in fishes, a respiratory act. Cocks, A. H. 1910.1; Elmhirst, R. 1910.1.

Caudal and cutaneous respiration

Ability to live by cutaneous respiration alone. Babák, E. 1914.1.

Caudal respiration in various fishes. Baumert, F. M. 1853.2.

Diminished resistance against silver salts in fishes with cutaneous respiration. Pigo-rini, L. 1907.1.

Caudal respiration in Periophthalmus. Haddon, A. C. Add. 1889.1; Hickson, S. J. Add. 1889.1.

ASPHYXIATION**Through respiratory interruption**

Effects of asphyxiation on heart and muscles. ★Polimanti, O. 1912.5, 1914.1.

Asphyxiation produced in water deprived of oxygen through boiling or by use of air-pump. Dissard, A. 1898.1; Gréhant, L. F. & Picard, — 1873.1; Boyle, R. Pre-Linn. 1670.2; Hauksbee, F. Pre-Linn. 1712.1.

Observations on the vitality or duration of life of fishes after removal from the water. Bert, P. 1868.1; Dissard, A. 1898.1; Evermann, B. W. 1913.2; Noé, J. 1893.1; Poluta, G. 1865.1; Schüz, E. 1866.1; Anon. 150, 333.

Asphyxiation produced by excess of carbon dioxide. Reuss, H. 1909.1, 2. — *Suffocation in water of marshes.* Rouget, C. 1868.1.

Asphyxiation caused by organic materials in water. Perrier, L. & Labatut, — 1900.1. — *For other papers of a similar nature, see under Pollution of Streams under Fisheries.*

RESPIRATORY ORGANS**ACCESSORY RESPIRATORY STRUCTURES****Non-vascular in nature**

Atrial chamber or peribranchial cavity in Amphioxus. Development, etc. Lankester, E. R. 1898.1; Lankester, E. R. & Willey, A. 1890.1; Legros, R. 1909.1; Willey, A. Add. 1890.1.

Opercular terminal membrane of Teleosts, aid in respiration. François-Franck, C. A. 1906.1, 3.

Pre-branchial appendages in Dicero-batis (Cephaloptera) consisting of elongated lamellæ functioning to retard the flow of water and thus aid in respiration. Duméril, A. H. 1870.4, 5; Panceri, P. & Sanctis, L. 1869.1.

Serrulæ or serrated throat appendages, possible respiratory function of, in Amia. Wilder, B. G. 1877.5, 1886.1; Wright, R. R. 1885.1.

Breathing valves. *Structure and function of maxillary and mandibular breathing valves in Teleostomi.* — *Polypterus.* Allis, E. P. 1900.2. — *Teleosts.* Dahlgren, U. 1898.2; ★Mitchell, E. G. 1904.1. — *Pleuronectidæ.* Schmidt, P. F. 1915.1.

Innervation of breathing valves. Fusari, R. 1907.2.

Spiracle or the persistent vestigial hyomandibular or first gill cleft. *Morphology.* — *Dipnoi.* Agar, W. E. 1906.2. — *Acipenser.* Virchow, H. 1890.3. — *Remnants in Amia and Lepidosteus.* Wilder, B. G. 1878.2; Wright, R. R. 1885.4. — *Anatomy and development in Ganoidei.* Dohrn, A. Add. 1886.1.

Anatomy and development in Elasmobranchii. Cleland, J. 1886.2; Ewart, J. C. (Lamna) 1890.3; Moroff, T. 1904.1; Ridewood, W. G. 1896.1; Turner, W. 1875.2; Virchow, H. 1890.2.

Functions of the spiracles. Budgett (J. S. 1903.1), in his work with *Polypterus*, observed the escape of air from the spiracles after the fish had gulped air at the surface. He believed that "the spiracles in this form are used to take in and to give out air from the swim-bladder."

Rand (H. W. 1907.1) observed the spouting of water from the spiracle in the skate (*Raja*) and concluded that in addition to this causing a respiratory incurrent through the mouth, the fish regularly employs spouting or the spiracular excurrent "as a means of keeping the eyes unobstructed."

Similar observations of Darbshire (A. D. 1907.1) with *Raja* indicate that this form expels water as "a means of ridding the pharynx of unpleasant matter."

Fulton (T. W. 1904.1, vi) has observed the reversed action of the gill-covers in plaice which were clinging to the tank with their snouts out of water. In this case the water was drawn in from behind through the gill-openings and spouted "as a little fountain, an inch or so in height."

VASCULAR RESPIRATORY ORGANS

True organs of respiration, of which gills form the usual type, found in all fishes.

Vascular filaments of pelvic fin of male Lepidosiren, presumed to function as adjunct respiratory organs during breeding season. Agar, W. E. 1908.1; Kerr, J. G. 1900.1; Lankester, E. R. 1894.1.

ACCESSORY BRANCHIAL ORGANS

For a comprehensive paper covering all types of accessory branchial organs, with a review of the literature, see ★Rauther, M. 1910.1.

Accessory organs (all types) in Indian fishes. ★Day, F. 1877.3; Hyrtl, C. J. 1858.3; Müller, J. 1840.4; Taylor, J. 1831.2, 1835.1.

Accessory branchial cavity. *Simple cavity lined by vascular membrane, of Ophiocephalidæ.* Grigorian, C. 1900.1; Hyrtl, C. J. 1853.1.

Arborescent appendages. — *Heterobranchus*, Alessandrini, A. 1842.1. — *Clarias*, Böhme, R. 1904.2; Sørensen, W. E. 1883.1; Vaillant, L. L. 1895.3, 1896.3.

Extensive air-sacs of Saccobranchus. Burne, R. H. 1894.1; Hyrtl, C. J. 1854.4; Wyllie, J. 1840.1.

Paired lung-like outgrowth of branchial cavity (caecal diverticula); small sacs in Amphipnous. Hyrtl, C. J. 1858.3; Taylor, J. 1831.2.

Gill-helix type of appendages. — *Hypophthalmichthys*, Boulenger, G. A. 1901.20. — *Heterotis*, and *Clupeidae*. ★Hyrtl, C. J. 1854.1, 1855.1, 1862.1, 1863.2. — *Characinidae*. Kner, R. 1861.2. — *Citharinus*, Sagemehl, M. 1886.1.

Arborescent appendages of Pæciliidae, chiefly Lebias. Mazza, F. 1907.1.

Labyrinthiform organs. *Structure, etc.* — *Labyrinthici*. Böttger, W. C. 1912.1; ★Henninger, G. 1908.1; Peters, W. C. H. 1853.1; Zograf, N. Y. 1886.1, 1888.1; Meyer, P. E. Add. 1904.1. — *Polyacanthus*. Hyrtl, C. J. 1863.4. — *Betta*. Schachmagonow, T. 1900.1.

EXTERNAL GILLS

Transitory in nature

For a comprehensive general treatise on external gills, see ★Clemens, P. 1895.1.

False External Gills

In the young of many Selachians and certain Teleosts, the gill lamellæ are prolonged as filaments which project to the exterior. In literature, these are generally called "external gills," although they should not be confused with the following type.

Structure and development in fetal Elasmobranchii. Blainville, H. M. 1818.3; Cornalia, E. 1856.1; ★Leuckart, F. S. 1836.1; Schenk, S. L. 1875.1.

For external gills of viviparous shark embryos acting as placenta, see Nourishment of embryo under Viviparity under Reproduction.

Structure in the Teleosts, Gymnarchus and Heterotis. Assheton, R. 1907.2; Budgett, J. S. 1900.5, 1901.1. — **Structure in Misgurnus (Cobitis).** Goette, A. 1878.3.

True External Gills

True external gills of the same morphological nature as those of Urodele amphibians, occur in Crossopterygii (Polypterus) and in the Dipnoans, Protopterus and Lepidosiren.

Structure of external gills in Protopterus. Budgett, J. S. 1900.5, 1901.1. — **In Lepidosiren.** Kerr, J. G. 1900.1.

Alleged but non-existent in Neoceratodus. Semon, R. 1894.1.

Structure of external gills of Polypterus. Boulenger, G. A. 1899.8; Budgett, J. S. 1900.4, 1901.1, 1902.2; Hyrtl, C. J. 1869.1; Steindachner, F. 1869.2; Anon. 200.

For the External gill hypothesis in the Phylogenesis of limbs, see under Evolution.

GILLS

For related structures see Branchial arches under Visceral skeleton.

For Gill-muscles, see under Myology.

For the latest and most authoritative works on the apparatus of respiration, see ★Oppel, A. Add. 1905.1, 1906.1.

Anatomy and morphology. *General researches.* Goette, A. 1901.1; Greil, A. (*Homologies*) 1906.2; Huschke, E. 1818.1; Popta, C. M. L. 1901.2, 3; Riess, J. A. 1881.1; Lereboullet, D. A. Add. 1838.1; Williams, T. Add. 1859.1.

Shorter papers on the morphology of the gills. Howes, G. B. 1891.3; Lo Giudice, P. 1910.1; Rosenthal, F. 1839.1; Treviranus, G. R. 1830.1; Baer, K. E. Add. 1827.1.

Structure of gills in various fishes. — *Orthogoriscus*. Alessandrini, A. 1839.1. — *Petromyzon*. Giacomini, E. 1900.1. — *Petromyzon and Myxine*. Home, E. 1815.3. — *Silurus*. Geoffroy-Saint-Hilaire, E. F. 1802.6. — *Amphioxus*. Spengel, J. W. Add. 1891.1. — *Syngnathus*. Tiedemann, D. F. 1816.1.

Development of gills. — *Teleosts*. ★Goette, A. 1878.3, 1901.1; Moroff, T. 1902.2, 1904.1. — *Ceratodus*. Greil, A. 1906.1; Kellicott, W. E. 1905.1. — *Bdellostoma*. Stockard, C. R. 1906.2, 1908.1.

Histology. Faussek, V. A. 1902.1; Montgomery-Vignal, M. W. 1874.1; Plehn, M. 1901.1. — *Elasmobranchii*. Alessandrini, A. 1840.1; Dröscher, W. 1881.1; Todaro, F. 1873.1, Add. 1873.1. — *Xiphias*. Trois, E. F. 1883.1.

PSEUDOBANCHIÆ

Accessory or rudimentary gills which in Ganoidei and Teleostei play some part in respiration.

Development, morphology and function. — *Teleostei*. Gemmill, J. F. 1899.1; Maurer, F. 1884.1, 1888.1; Müller, J. 1839.2, 1840.2, 4, 1841.1, 3; ★Grassi, G. B. Add. 1914.2. — **Morphology and development, Lepidosteus.** ★Müller, F. W. 1897.1. — **Morphology, Ganoidei.** Wright, R. R. 1885.2, 4. — **Ganoidei and Teleostei.** Dohrn, A. Add. 1886.1.

RIBS OF FISHES

As first shown by Goette (A. 1878.1.) two morphologically independent structures have been known under the name of "ribs," in addition to the intermuscular or small bones found in the myosepta of Teleosts.

The dorsal ribs lie at the level of the horizontal septum dividing the lateral musculature. They occur in Elasmobranchs and are considered as homologous with the ribs of Amniotes.

The ventral ribs lie immediately outside the splanchnocoelic lining and are apparently serially homologous with the hæmal arches of the caudal vertebræ. In general in Teleostomes and Dipnoi, only this type of rib is found.

Both sets of ribs occur in the Crossopterygii.

For an excellent account of the development of the ribs in fishes, see ★Schauinsland, H. Add. 1905.1.

Ribs — *Cont'd.*

Anatomy and morphology of the fish ribs. ★Baur, G. H. 1887.3, 1889.1, 1893.1; Cleland, J. 1863.1; ★Dollo, L. 1892.2; Eschricht, D. F. 1850.1, 1851.1; ★Goepfert, E. 1895.1, 1897.1; Hatschek, B. 1889.2; Lavocat, A. 1889.1; Mayerhofer, F. 1908.1; Müller, A. 1853.1; Wilbrand, J. B. 1824.1, 1838.1; Claus, C. Add. 1877.1.

Demonstration of presence (previously denied) in Polyodon of cartilaginous ribs. Bridge, T. W. 1897.2, 3.

Presence anteriorly of both types of ribs in Polyacanthus. Hyrtl, C. J. 1863.4.

Description of a pair of freely articulated occipital "ribs" in Micropterus. Shufeldt, R. W. 1884.1, 2. — *Suggestion that these are rudiments of the supraclaviculae.* McMurrich, J. P. Add. 1884.1.

SENSES AND SENSE ORGANS (OF FISHES)

For the morphology of the various organs of sense, see under Auditory organs, Gustatory organs, Eye, Olfactory organs, and Tactile organs.

For the functions of these organs, see Hearing, Smell, Taste, and Vision.

For local and specialized sense organs, see under Lateral line system, and Nervous system.

For all psychological reactions in fishes, involving sensory perceptions, see under Behavior.

Morphological and physiological classification of sense organs. Herrick, C. J. 1903.1.

General treatises on sense organs. Chatin, J. 1880.1; Lenhossék, M. 1894.1, 1895.1; ★Lubosch, W. 1910.1.

Branchial sensory organs (ectodermal thickenings above each gill cleft, from which arise lateral line and mucus canal sense organs) and their phylogenetic significance. Beard, J. 1885.2; Beraneck, E. 1889.1; Peter, K. 1901.1; Wilson, H. V. 1897.1.

General treatises on the senses of fishes. ★Baglioni, S. Add. 1912.1; ★Nagel, W. A. Add. 1894.1.

Electric and magnetic dermal senses. Dunn, M. Add. 1899.1.

End organs or the nerve-end apparatus. Called also epidermal sense organs (*Hautsinnesorgane*) or terminal buds. (It is impossible at present to state with certainty the functions of these nerve end organs and to assign them to the different senses).

General treatises. ★Leydig, F. 1895.1; ★Merkel, F. 1880.1.

Anatomy and morphology. Afanassjew, M. J. 1874.1; Herrick, C. J. 1903.2; Hofer, B. 1908.1; Leydig, F. 1879.1, 1888.1; Ritter, W. E. 1893.1; Schulze, F. E. 1863.1; Trojan, E. 1904.1, 1905.1; Lenhossék, M. Add. 1894.1.

End organs of trigeminus and lateralis nerves, Bdellostoma. Ayers, H. & Worthington, J. 1907.1.

Skin sensory organs, relation to mammalian hair. Leydig, F. 1893.1; Maurer, F. 1893.1, 1895.1.

Skin sensory organs of Fierasfer. Nusbaum, J. & Bykowski, L. 1905.1. — *Spinax.* Rund, G. Add. 1914.1.

Presence of terminal organs resembling touch corpuscles in intra-muscular connective tissue. Purvis, G. C. 1890.1.

For nerve terminations in particular organs, see "Innervation" under such organs as Heart, Integument, etc.

SEX-RATIO (IN FISHES)

The relative proportions of the sexes in fishes.

General papers. Fulton, T. W. 1890.4; Pittet, L. Add. 1914.1.

The sex-ratio in — Gasterosteus. Braun, M. G. 1904.1. — *Salmon in Scottish rivers.* Calderwood, W. L. 1904.1. — *Sharks and rays.* Fulton, T. W. 1903.2; Haacke, W. Add. 1885.1. — *Plaice.* Hefford, A. E. 1909.1. — *Syngnathidae.* Marcusen, J. 1873.1. — *Spinax.* Punnet, R. C. 1904.1.

Sex-ratio in broods of aquarium fishes, chiefly viviparous Pæciliidae, alleged to vary from nearly all males to nearly all females according to age of parent fishes. Thumm, J. 1908.1 (pp. 519–521).

For an illuminating suggested explanation of similar fluctuations in the sex-ratio of Lebistes reticulatus, see ★J. S. Huxley, in *Journal of Genetics*, 1920, vol. 10, pp. 265–276. Huxley suggests that instead of sex-determination by chromosomes being fixed and unmodifiable, there is a possibility of external factors overriding their effects, and that thus some males are "masculinized females," i. e. males with XX or female genetic constitution. Such individuals will always give a preponderance of the sex opposite to their own.

For the sex-ratio of Lebistes in a wild state considered the normal 1:1 ratio, see Henn, A. W. 1916.1 (p. 106).

Case of sex reversal or "arrhenoidie" in a viviparous Pæciliid; in a female, the anal fin elongated to twice its normal length, resembling the characteristic appearance of half-grown males. Philippi, E. 1904.1.

For additional discussion of the sex-ratio of the Pæciliidae, see R. L. Barney & B. J. Anson, in *Ecology*, 1921, vol. 2, pp. 53–69.

SEXUAL DIMORPHISM

General treatises on the sexual dimorphism of animals, including fishes. ★Cunningham, J. T. 1900.2; ★Darwin, C. R. 1883.1.

Miscellaneous papers. Holt, E. W. 1898.1; Surbeck, G. 1913.1, 1914.2; Landeck, A. Add. 1914.1.

Sexual dimorphism shown in dentition of — Raja. Lütken, C. F. 1874.3, 5. — *Notidanus.* Macdonald, J. D. & Barron, C. 1868.1. — *Mobula.* Pellegrin, J. 1912.12.

Sexual dimorphism shown in rostral spine of males of Myriacanthus, Squaloraja, and Chimæra. Davies, W. 1872.1; Dean, B. 1906.1; Reis, O. M. 1895.2; Woodward, A. S. 1906.3.

Sexual dimorphism in — Anal fin, Mal-lotus. Agassiz, J. L. 1860.1. — *Pectoral fin, Cobitis taenia.* Canestrini, G. 1871.3,4; Troschel, F. H. 1871.1. — *Pectoral fins, Cyprinidae.* Fatio, V. 1875.1. — *In size.* Fulton, T. W. 1890.4. — *In skeleton.* Günther, A. C. 1859.3.

For sexual dimorphism in pelvic fins of sharks, see Copulatory organs under Viviparity in section on Reproduction.

For the differentiation of the male anal fin of Pæciliidae as an intromittent organ, see under Ovarian gestation under Viviparity as above.

Frontal gibbosity, a swelling or protuberance on the head of certain male fishes, which may be considered a secondary sexual character. It becomes gradually more prominent as sexual maturity is reached, and is very greatly enlarged during the breeding season. — General account of anatomy and physiological significance. Pellegrin, J. 1904.2. — *Geophagus and Cichla.* Agassiz, L. & Agassiz, E. C. 1868.1; Steindachner, F. 1874.3, 1877.1 (i). — *Julis and Scarus.* Cuvier, G. & Valenciennes, A. 1828.1 (vol. 14). — *Semicossyphus.* Günther, A. C. 1859.1. — *Pimelometopon.* Jordan, D. S. & Evermann, B. W. 1896.2. — *Percidae.* Pellegrin, J. 1901.2. — *Ptychochromis.* Pellegrin, J. 1907.14.

Sexual dimorphism in various Teleosts

Sub-order Acanthopterygii. — Callyodon. Bloch, M. E. 1788.3. — *Arnoglossus.* Cunningham, J. T. 1890.1. — *Rhomboidichthys.* Facciola, L. 1886.1. — *Smaris.* Facciola, L. 1899.1. — *Lepadogaster.* Guitel, F. 1890.4. — *Hemichromis.* Kutzner, A. 1909.1. — *Cichlasoma.* Reuter, F. 1914.1. — *Coris.* Trois, E. F. 1905.1. — *Lucioperca.* Vutskits, G. 1915.1, 1916.1. — *Mesogonistius.* Anon. 263. — *Pterophyllum.* Conn, C. Add. 1914.2.

Sub-order Ostariophysi. — Tinca. Andres, A. 1897.1; Canestrini, G. 1872.1. — *Rasbora.* Arnold, J. P. 1911.25. — *Callichthys.* Kner, R. 1854.3. — *Corydoras.* Steindachner, F. 1910.2. — *Neosilurus.* Troschel, F. H. 1870.1. — *Leucaspis.* Vutskits, G. 1903.1.

Fishes of various other sub-orders. — Coregonus. Carpenter, C. 1878.1. — *Stigmatopora.* McCulloch, A. R. 1914.3. — *Syngnathidae.* Marcusen, J. 1873.1. — *Cynolebias.* Regan, C. T. 1912.22.

For sexual dimorphism in eels, see Sexes of Eels, under *Anguilla* in the Systematic part of the Subject Catalogue.

SKELETON OF FISHES

Comprising the morphology of the inner cartilaginous or bony endoskeleton, and the general subject of Osteology.

The "exoskeleton," consisting of the dermal denticles and scales, is treated under the caption "Dermal skeleton."

The wide usage, among authors, of the term "exoskeleton" for the dermal skeleton has necessitated the retention of this term in the

present work. Long ago, Ryder (J. A. 1885.2, p. 204) pointed out that "the distinction between the fin-rays as exoskeletal, from the other bones as endoskeletal, . . . breaks down on embryological grounds, for both are clearly of mesoblastic origin." More recently, Prof. J. G. Kerr (Text-book of Embryology, vol. 2, p. 289) considers the use of the term "exoskeleton" for fish-scales as unfortunate, and limits this term to the true chitinous exoskeleton of various invertebrates.

The present section is largely limited to general papers on the fish-skeleton. The full literature will be found by reference also to the papers cited under Pectoral girdle; Pelvic girdle; Ribs; Skull; Vertebral column; and Visceral skeleton.

The abnormalities of the skeleton are listed under Teratology.

For the preparation of skeletons for research and class room work, see Technical methods, etc.

The many described forms of fossil fishes are known solely from their skeletal remains. The extensive literature can, of course, not be included here. Reference should be made elsewhere in this work and also especially to the "catalogue" of Woodward (A. S. 1889.2).

General treatises

No satisfactory general treatise on the skeleton of fishes, of recent date, exists. The following references comprise the existing general treatises.

Text in English. Owen, R. 1848.1, 1866.3; ★Reynolds, S. H. 1913.1.

Text in French. Lidth de Jeude, T. W. 1898.1; ★Pouchet, G. & Beauregard, H. 1889.1; ★Stéphan, P. 1900.1; Owen, R. Add. 1855.1.

Text in German. Brühl, C. B. 1856.1, 1887.1, Add. 1845.1, 1847.1.

An early general treatise, in English, is Cheselden, W. Pre-Linn. 1733.1.

For the synonymy of the numerous terms which have been applied to the bones of the fish-skeleton, see ★Starks, E. C. 1901.1.

Miscellaneous papers

The following citations represent older, unimportant, and miscellaneous papers on the skeleton of fishes. Ekama, C. 1822.1; Geoffroy-Saint-Hilaire, E. 1817.2, 1824.2; Hoeven, J. 1822.1; Hollard, H. L. 1861.1; Macdonald, W. 1838.1, 1872.1; Mivart, St. G. 1871.1; Owen, R. 1846.2; Rosenthal, F. 1811.1; Segond, L. A. 1873.1; Sgarzi, G. 1849.1; Shufeldt, R. W. 1916.1.

Tissues characterized by the presence of a high proportion of intercellular substance, or matrix, which is a product of the surrounding cells themselves, occur widely distributed throughout the animal body. When the intercellular substance is sufficiently dense, or is strengthened by the deposition of lime salts, these tissues may provide support for the other body tissues.

SKELETOGENOUS TISSUES

The skeletogenous or connective tissues, including cartilage and bone, all arise from the mesenchyme.

The Connective Tissues

Comprising areolar, reticular, fibrous, and elastic tissues, which have not been separated in the following references.

Skeleton — Cont'd.

The most comprehensive general treatise on the origin and development of connective tissue (in German), with an extensive bibliography, is ★Merkel, F. 1909.1.

Various papers on the development, histology, histogenesis, etc., of connective tissue are Ebner, V. 1896.1; Ferguson, J. S. 1912.1; Goldschmidt, R. 1908.1; ★Key, A. & Retzius, G. 1875.1; Müller, E. 1912.1; Policard, A. 1902.1; Studnička, F. K. 1897.6, 1902.1, 1906.2, 1907.1; ★Szily, A. 1908.1.

The umbilical cord of mammals is composed of a mesenchymal tissue known as "mucous tissue." For the structure of an analogous connective tissue in the "umbilical cord" (yolk-sac) of *Torpedo*, see Laguesse, G. E. 1911.1, 1913.1.

For the references to "Fat, or adipose tissue," which is formed from areolar connective tissue, see under Chemistry.

Cartilage

Cartilage, a dense tissue possessing flexibility and elasticity, forms the skeletal tissue of Cyclostomes and Elasmobranchs and is in these forms never replaced by bone.

In the embryo or larval bony fish (Teleost), and in all higher vertebrates, the skeleton is originally formed of hyaline cartilage, which is later replaced by bone.

In adult Selachians, cartilaginous structures, such as the vertebræ, usually become "calcified" or hardened by the deposition of calcium carbonate in the form of polygonal plates between the peripheral cartilage cells, as is best shown by Lubosch (W. 1909.1) and by Roth (W. 1911.1, p. 496). Despite the statements of Stark (James 1844.2), true bone is not developed in these fishes.

The origin of cartilage is difficult to follow. As quoted from an abstract in the Journ. Roy. Micro. Soc., 1898, 2nd. series, vol. 17, p. 290, "Prof. F. K. Studnička, [1898.4] shows that the origin of cartilage does not imply occurrence of special cells. In the post-embryonic life of Cyclostomes, cartilage may arise from (1) the dense connective-tissue of perichondrium and fascia; (2) the loose connective-tissue; (3) the so-called *Schleimknorpel*; (4) the *Vorknorpel* (vesicular supporting tissue of Schaffer); (5) the axial connective-tissue of the caudal fin; (6) highly specialized tissue, such as fatty tissue; and (7) the epithelium of the notochord."

The most extensive recent summary of this subject, with a full bibliography, is ★Studnička, F. K. 1903.2.

Excellent treatises, containing complete bibliographies, on the development of hyaline cartilage in all groups, are ★Novikov, M. M. 1908.1; and for the chemical composition especially, ★F. C. C. Hansen in Anat. Hefte, 1905, Bd. 27, Hft. 83, pp. 535-820, 10 pls.

The structure of cartilage in the Cyclostomes is most completely treated by ★Schaffer, J. 1896.1-1901.2, 1910.1; and by ★Studnička, F. K. 1897.4, 6, 1898.1, 4.

The histological structure in Elasmobranchs is treated by Hasse, J. C. 1879.2, and by ★Roth, W. 1911.1.

Other papers on the development or structure of cartilage are Nardo, G. D. 1843.1, 1845.1; Retterer, E. 1907.1; Srdinko, O. V. 1902.1; Valenciennes, A. 1851.3; and Kaschkaroff, D. N. Add. 1914.2.

The development of cartilage and cartilage cells has been especially studied in connection with the development of the notochord and the vertebral column. For references, see under Vertebral column.

For the chemical composition of cartilage, see under Chemistry.

Bone

True bone is characterized by the presence of included bone-cells (called also bone-corpuscles, calcigerous cells, and osteoblasts), which generally occupy the lacunæ of the Haversian system and thus are included in or surrounded by the lamellated bone matrix. It is first met with in the "bony fishes" (Teleostomes).

Dentine, closely allied to bone, is more dense and its formative cells (scleroblasts or odontoblasts) are not included in the matrix. The scleroblasts, which secrete the dentine, line the proximal side of the developing denticle or tooth so that growth, in contrast with bone, is in only one direction, i. e. outward. Dentine occurs in the dermal denticles of Elasmobranchs (see Dermal skeleton) and in the teeth of these fishes and all higher vertebrates (see Dentition).

Modern views on the histology of the bone of fishes begin with the work of H. Müller (Zeitschr. wiss. Zool., Bd. ix, 1858) who first correctly distinguished ossification (from calcification) as the osteoblastic elaboration of cartilage. Williamson (W. C. 1851.1) previously had considered bone to be formed by the calcification of cartilage.

Many genera of Teleosts possess no "bone corpuscles" (i. e. lacunæ occupied by osteoblasts) and their bones therefore in minute structure much resemble dentine. This subject has been elaborated by Kölliker (R. A. 1859.1, 2) who microscopically examined more than two hundred species of fishes. He found that "most of the higher organized fishes are amongst those with bone-corpuscles," including roughly the Physostomi; Malacopterygii and Ostariophysi (except Thricomycter), and the Ganoids. Those without "bone-corpuscles" roughly include the Anacanthini and Pharyngognathi, the Symbranchii, Haplomi, Plectognathi, and all of the "Acanthopteri, with the exception of the genus *Thynnus*," etc. For the tissue lacking bone corpuscles, Kölliker (R. A. 1859.2, p. 258) used the term "osteoides Gewebe." This work has served as the basis for most modern histological researches on the bones of fishes.

The lack of bone-cells was originally noted by ★Queckett (J. T. 1849.1); by Williamson (W. C. 1851.1, p. 693); by Kölliker (R. A. 1853.1, p. 361); and by Mettenheimer (C. F. 1854.1).

Pouchet observed that, in the same individual, some bones may possess bone-cells while others lack them. Pouchet, G. 1875.2.

Other papers also containing accounts of the bone-cells. Goette, A. 1878.1 (v); Grassi, G. B. 1885.1; and ★Stéphan, P. 1898.2.

The most valuable paper on the histology of the bones of fishes (in French), containing a historical and a full bibliographic résumé, is ★Stéphan, P. 1900.1.

Papers treating of various phases of the histology or histogenesis of the bones of fishes. Aladyna, M. 1910.1, 2; ★Gegenbaur, C. 1864.1, 1867.2; Goodrich, E. S. 1913.2; Köstler, M. 1882.1; Renaut,

J. 1902.1; Retterer, E. 1905.1-3;
★Schmid-Monnard, C. 1893.1; Stieda,
L. 1872.1; Studnička, F. K. 1906.2;
Williamson, W. C. 1851.1; Kaschkaroff,
D. N. Add. 1914.3.

True bone occurs in the Coccosteomorphi (Arthrodira). Gebhardt, W. 1907.1.

The histological structure of bone, in the ocean sun-fish, Orthogoriscus, has been much studied. The most recent paper (Kaschkaroff) considers them without bone cells. This paper also reviews all preceding papers. Beauregard, H. 1893.1; Cleland, J. 1862.1; Harting, P. 1865.3; Kölliker, R. A. 1860.8; Novikov, M. M. 1909.1, 1910.1; Supino, F. 1904.1; ★Kaschkaroff, D. N. Add. 1914.3.

The osteoblasts, previously generally considered mesodermal in origin, were described by Klaatsch (H. 1894.1) as arising in the ectoderm and thence migrating into the mesoderm. This possibility was reviewed by Kingsley (J. S. 1894.1). Harrison (R. G. 1895.1) re-investigated the matter and reaffirmed their mesodermal origin. These older views are likewise maintained in a more complete review by ★Rosén (N. 1910.1).

SKELETON BY GROUPS

The skeletons of the following forms are more completely treated elsewhere herein under the constituent parts, such as Pectoral girdle; Pelvic girdle; Skull; Vertebral column; and Visceral skeleton. The following references therefore chiefly constitute accessory, general, inclusive, or unclassifiable papers.

CYCLOSTOMATA

Ayers, H. & Jackson, C. M. 1900.1;
Cole, F. J. 1905.1; Gegenbaur, C. 1870.3;
★Parker, W. K. 1884.1; Schaffer, J. 1901.2; Perepelkin, K. Add. 1882.1.

DIPNOI

★Fürbringer, K. 1904.1; Wiedersheim, R. E. 1880.2.

ELASMOBRANCHII

Baudelot, E. 1869.3; Goodey, T. (Chlamydoselachus) 1910.1; ★Haswell, W. A. 1885.2; Jaquet, M. (Pseudotriacis) 1905.1; Molin, R. 1853.2, 1859.1; Regan, C. T. 1906.1; Treviranus, G. R. 1804.1.

Excellent figures. Garman, S. 1913.1.

CHIMÆRIDÆ

Skeletons figured and described. Garman, S. 1904.1.

OSTEOLOGY OF TELEOSTOMI

Chondrostei and Holostei. Anatomy of the skeleton of — Polyodon. ★Bridge, T. W. 1878.1. — "Knochenanoiden." Cafauek, F. 1883.1. — *Acipenser.* Molin, R. 1851.2; Zаленский, V. V. 1878.1. — *Amia.* ★Shufeldt, R. W. 1885.1.

Teleostei

It should be stated here that most of the following references include the struc-

ture of the skull. Other parts of the skeleton, such as the vertebral column, pectoral girdle, ribs, etc., receive treatment but less generally than the skull, which is almost always included.

Sub-order Malacopterygii

Structure of the skeleton of — Coregonus. Bayer, F. 1889.1. — *Salmo salar.* Bruch, C. W. 1861.3, 1862.1; Morrow, R. 1880.1. — *Gymnarchus.* Erdl, M. P. 1847.1. — *Alosa sapidissima.* Hitchcock, F. R. 1887.2, 1888.1. — *Clupeidæ.* Hyrtl, C. J. 1861.2. — *Mormyridæ.* ★Marcusen, J. 1864.1. — *Cromeria and Galaxias.* Swinnerton, H. H. 1903.1.

Sub-order Ostariophysi

Skeleton of Characinidæ. — *Gastropelecus.* Ridewood, W. G. 1913.1; Young, G. W. 1915.1.

Skeleton of Cyprinidæ. — *Tinca.* Andres, A. 1897.1, 1899.1. — *Cyprinus carpio.* Bruch, C. W. 1861.2; Brühl, C. B. 1891.4; Maslowsky, A. 1855.1.

Skeleton of Siluridæ. — *Malopterurus.* Cleland, J. 1858.1. — *Siluridæ.* Hyrtl, C. J. 1859.1; ★Koschkarov, D. N. 1905.1. — *Amiurus.* McMurrich, J. P. 1884.2.

Sub-order Apodes

Osteology of the fishes of the sub-order Apodes. Regan, C. T. 1912.15.

For the osteological characters of the following families of the sub-order Apodes, see the present citations under Gill, T. N. as follows. — *Anguillidæ.* 1891.8. — *Muraenesocidæ.* 1891.10. — *Muraenidæ.* 1891.11. — *Simenchelyidæ.* 1891.12. — *Synphobranchidæ.* 1891.13.

Sub-order Haplomi

For the most recent delimitation of this group, see Regan, C. T. 1911.15.

Osteology of Dallia pectoralis. Starks, E. C. 1904.1. — *Esocidæ.* Starks. 1904.3.

Sub-order Catosteomi

Osteology of — Lampris guttatus. Bakker, G. 1822.1; Ekhoft, E. 1875.1. — *Lophobranchii.* Jungersen, H. F. 1909.1. — *Syngnathus.* McMurrich, J. P. 1883.1.

Osteology of the Hemibranchii, including the following families or genera: Aëoliscus, Aulichthys, Aulorhynchidæ, Aulostomidæ, Centriscidæ, Fistulariidæ, Gasterosteidæ, and Macrorhamphosidæ. Starks, E. C. 1902.2.

Sub-order Percosoces

Osteological characters of the fishes of the following families or genera: Atherinopsis, Menidia, Mugilidæ, and Sphyrænidæ. Starks, E. C. 1899.1.

Osteology of Ophiocephalus. Day, A. L. Add. 1914.1.

Sub-order Anacanthini

Osteology of the Gadidæ. Bakker, G. 1822.1; Brooks, H. St. J. 1885.1; Newton, E. T. 1895.1, Add. 1875.1; Williamson, H. C. 1902.1.

Skeleton — Cont'd.

Sub-order Acanthopterygii

Structure of the skeleton of — *Cataphracti*. Berg, L. S. 1906.12. — *Pleuronectes*. ★Cole, F. J. & Johnstone, J. 1901.1. — *Lutjaninae*. Gill, T. N. 1885.4. — *Etheostominae*. Jordan, D. S. & Eigenmann, C. H. 1886.1. — *Lopholatilus*. Lucas, F. A. 1905.1. — *Thynnus*. Masterman, A. T. 1894.1. — *Regalecus*. ★Parker, T. J. 1886.3. — *Micropterus*. Shufeldt, R. W. 1884.1,2, 1901.10. — *Kurtus*. Beaufort, L. F. Add. 1914.1.

Skeleton of *Luvarus imperialis* (*Ausonia* and *Proctostegus* are synonyms). Günther, A. C. 1866.7; Nardo, G. D. 1827.1, 1840.1; Regan, C. T. 1903.9; Waite, E. R. 1902.3.

Osteology of the *Scombridae* and *Carangidae*. Regan, C. T. 1909.13; Starks, E. C. 1909.1, 1910.1, 1911.4,5; Vaillant, L. L. 1885.2.

Osteology of some berycoid fishes (*Berycoidea*), including the following families or genera: *Holocentridae*, *Hoplostethus*, *Monocentridae*, *Myripristis*, *Polymixidae*, and *Trachichthyidae*. Starks, E. C. 1904.2.

For additional papers on this group, see below under "Researches of Starks."

Sub-order Pediculati

Skeletal anatomy of — *Ceratias*. Lütken, C. F. 1880.1,4. — *Lophius*. Morrow, R. Add. 1882.1.

Sub-order Plectognathi

Skeleton of — *Balistes*. Brühl, C. B. 1891.2; Hollard, H. L. 1853.1; Klein, E. E. 1872.1. — *Triodon*. Dareste, C. 1849.1. — *Gymnodontidae*. Hollard, H. L. 1857.1, 1860.1. — *Diodon*. Shufeldt, R. W. 1917.2.

Special researches on the osteology of Teleosts

Since the taxonomic groupings, such as orders and sub-orders, are largely based on skeletal or skull characters, an extensive literature has been developed. It is of course obviously impossible to note here all of the many taxonomic works containing summaries of such distinctive characters. The following references primarily define the osteological basis for these groupings. The chief workers in this field are Gill, Regan, and Starks.

Reference may advantageously be made to "The orders of teleostomous fishes." ★Gregory, W. K. 1907.1.

Researches of Gill

The chief references to this author are ★Gill, T. N. 1885.4, 1891.7-13. See also those cited under "Apodes." See also, for — *Amphipnoidae*. 1891.7, and — *Hemipteridae*. 1891.9.

Researches of Regan

Papers of the highest type, defining the osteological characters of the following groups (considered "orders" unless otherwise stated), are cited under ★Regan, C. T. as follows. — Sub-order *Allotriognathi*, including the families *Lamprididae*, *Veli-*

feridae, *Trachypteridae*, and *Lophotidae*. 1907.11.

Scombriformes, including *Carangidae* and *Scombridae*. 1909.13. — *Iniomi*. 1911.2. *Salmopercae*. 1911.3. — *Berycomorphi*, and *Xenoberyces*. 1911.4. — *Gobioidae*, 1911.14. — *Microcyprini*. 1911.15. — *Apodes*. 1912.15. — *Opisthomi*. 1912.16. — *Scleroparei*. 1913.13.

Researches of Starks

Works likewise of the very highest order, and having the advantage of excellent illustrations, are those cited under ★Starks, E. C. 1898.1-1911.5. In detail, they are listed partly above under *Catosteomi*, *Percesoces*, and *Acanthopterygii*, and partly under the following families or genera of *Acanthopterygii*. — *Sebastolobus*. 1898.1. — *Zeidae*. 1898.2. — *Dinolestes*. 1899.2. — *Antigoniidae*. 1902.1. — *Caularchus*. 1905.1. — *Stylephorus*. 1908.1. — *Gempylidae*, *Lepidopidae*, and *Trichiuridae*. 1911.3. — *Leiognathus*. 1911.4.

SKULL OF FISHES

The full literature on the skull will be found by consulting also the sections on Skeleton and Visceral Skeleton.

For the "Abnormalities of the skull," see under Teratology.

"The skull is a complex structure and the last word concerning its composition has yet to be said." (Kingsley.)

Probably the most valuable general treatise on the development and morphology of the vertebrate skull (text in German), with a full bibliography, is ★Gaupp, E. Add. 1905.1.

Unquestionably the most learned treatises in English, illustrating the anatomy of the fish skull (bones, nerves, foramina, etc.) in remarkable detail, are those cited under ★Allis, E. P. 1897.1, 1898.3, 1899.2, 1900.2, 1903.4, 1904.1, 1907.1, 1909.1, 1913.1, etc.

Other valuable treatises on the morphology of the fish skull, in English, are those of ★Parker, W. K. 1872.1, 1879.2, 1881.1, and 1882.1.

Various papers of a general or unclassified nature including the morphology of the fish skull. Baur, G. H. 1889.2; Geoffroy-St.-H., E. F. 1807.1, 1824.1, 1825.2; Goodsir, J. 1857.2; ★Gregory, W. K. 1913.1; ★Klein, E. E. 1868.2; ★Köstlin, O. 1844.1; Mead, C. S. 1904.1; Owen, R. 1848.1; ★Parker, W. K. & Bettany, G. T. 1877.1; Spitznagel, F. 1821.1; Sutton, J. B. 1887.1; Voskobolnikov, M. M. 1914.1; Wright, William. 1909.1.

PHYLOGENY OF THE SKULL**Vertebral theory of the skull**

Many of the statements in the present summary are based on the above account of Gaupp (E. Add. 1905.1).

"A young skull" (says Huxley, T. H. Add. 1859.2, p. 383) "may be readily separated into a number of segments, in each of which it requires but little imagination to trace a sort of family likeness to such an expanded vertebra as the atlas."

"What can be more natural than . . . to conceive the skull as a portion of the vertebral column still more altered than the sacrum or the coccyx, whose vertebrae are modified in correspondence with the expansion of the anterior end of the nervous centre."

Precisely this conception arose in the mind of the "fanciful philosopher" Oken after observing the bleached skull of a deer which he picked up one day in 1806 in the Harz forest.

These views, published in 1806 but chiefly expressed in lectures, met with general acceptance (Bojanus, L. 1818.1, .2). In 1820, the poet Goethe in his "Morphologie" stated that, thirty years previously, he had discovered this relationship and the vertebral theory has subsequently often been known as the Goethe-Oken theory. Goethe's pretensions are effectually disposed of by Oldfield Thomas (Encyc. Brit., 11th ed., 1911, vol. 20, p. 56).

Opinions differed, however, as to the number of hypothetical vertebrae; Goethe declared six, Oken three and later four, and this number was also accepted by Rathke in 1839, by Owen (R. 1846.1), Bruch (C. 1862.1), and by others, the highest number suggested being seven.

The theory, which had much declined, was again revived with vigor in 1848 by Owen (R. 1848.1).

In 1858, Huxley (T. H. Add. 1859.2) delivered his famous Croonian lecture on the vertebrate skull, in which he effectually disposed of the Okenian views, as applied to the segmentation of the bony skull, with the concluding statement (p. 433).

"The perfectly ossified skull is divisible into a series of segments, whose *analogy* with vertebrae is closer the nearer they lie to the occipital region; but the relation is an analogy and not an affinity and these cephalic sclerotomes are not vertebrae."

Modern views

In 1872, Gegenbaur (C. 1864.2, iii) published his epoch-making work on the Selachian skull. In this he transferred the fundamental idea of segmentation to the chondrocranium which although forming a continuous structure in the adult Selachian, exhibits, especially behind the infundibulum, many signs of an original metameric or segmental structure. Gegenbaur conceived of the skull as composed of an anterior *prevertebral* region, chiefly formed by a forward growth around the nasal organs and including the ethmoid region, and a posterior *vertebral* region comprising the occipital, auditory, and part of the orbital regions. This latter region overlies the notochord, precisely as does the vertebral column, and it gives exit to the segmental nerves which he considered spinal nerves. He believed the fused vertebrae to number at least nine, chiefly because of the visceral arches (Bogenbildungen) which he interpreted as ventral or hæmal arch formations, serially homologous with ribs.

Stöhr (P. A. 1882.1; Zeits. Wiss. Zool., 1879, vols. 33, 34) soon added the fruitful idea that the fusion of vertebrae had progressed from front to rear; that this caudal progression is still continuing; and that it had proceeded unequally in different groups, the skull of some forms having absorbed more vertebrae than that of others.

This last idea has become further extended through the researches of Rosenberg (E. W. 1884.1, 1887.1), of Gegenbaur (C. 1887.1), and of Sagemehl (M. 1884.1). Rosenberg concluded that the correct conception of the Selachian skull is not that of a fixed size but that, for example, the cranium of *Carcharias* includes one vertebra more than that of *Mustelus*. Sagemehl going still farther, believed that, in mode of origin, the skull may be divided into (1) the *protometameric* type, found in Selachians and Amphibia, which is formed by the fusion, not of vertebrae, but of metameres or somites and (2) the *auximetameric* type of Teleostomes and Amniotes, in which the three anterior vertebrae of the vertebral column, having lost their freedom of motion through the backward projection of the parasphenoid, have been incorporated into the cranium. With these views, however, Gegenbaur is not in agreement.

Various papers on the morphology of the occipital region of the skull with especial reference to the vertebral theory. Bertini, E. 1907.1; Brachet, A. 1909.1; ★Brohmer, P. 1909.1; Drüner, L. 1905.1; Froriep, A. 1905.1, .3; ★Gegenbaur, C. 1871.1, 1887.1, 1888.1, 1912.2; Nusbaum, J. 1908.1; Rohon, J. V. 1894.1, 1895.2; Wijhe, J. W. Add. 1889.1.

For the coalescence of vertebrae with the occipital region of the skull in various families of Ostariophysi (particularly Cyprinidae and Siluridae) in connection with the development and morphology of the Weberian apparatus, see that topic under Auditory Organs.

Development of the skull

"It has now been conclusively shown" (quoting from Goodrich, E. S. 1900.1, p. 11) . . . "that skeletal segments of vertebral nature do, in the course of ontogeny, and doubtless also in that of phylogeny, become embodied in the occipital region carrying with them their corresponding nerves. Originally spinal nerves thus come to pass through the cranial wall—so called spino-occipitals."

"This gradual inclusion of skeletal segments, scleromeres, in the occipital region of the skull of fish has lately been followed in great detail from embryo to adult by [our citations] ★Severtzov, A. N. 1895.1, 1897.1; Hoffman, C. K. 1894.1, 1896.1; Braus, H. 1899.1; and Schreiner, K. E. 1902.1."

For the intimately related topic of the segmentation of the head, see Metamerism under Head.

Papers treating primarily of the chondrocranium of fishes. Filatoff, D. 1906.1; Gegenbaur, C. 1867.2; Veit, O. 1907.1,

Skull — Cont'd.

1911.1; Voskoboïnikov, M. M. 1910.1;
★Winslow, G. M. 1898.1.

Those treating especially of the origin of the membrane bones (*Deckknochen*). Gaupp, E. 1903.1; Goeldi, E. A. 1884.1; and Walther, J. K. 1883.1.

Other papers treating both of the development of the chondrocranium and the bony skull of the Teleosts in general, and especially of *Salmo*. ★Böcker, H. 1913.1; ★Klein, A. 1884.1; Parker, W. K. 1872.1; Pouchet, G. 1874.1; ★Rosén, N. 1910.1; ★Schleip, W. 1903.1; ★Swinerton, H. H. (*Gasterosteus*) 1902.1; Tikhomirov, A. A. 1885.1; Vrolik, A. J. 1873.1; Willcox, M. A. 1899.1; Ganin, M. Add. 1880.1.

MORPHOLOGICAL TOPICS**Concerning the skull**

There is an extensive literature on the skull concerning the determination of the homologies of the various cranial and skull elements throughout the vertebrate and especially the Tetrapod series. This literature is obviously beyond the sphere of the present work.

Orbitosphenoid, structure. Starks, E. C. 1908.3. — *Sphenotic.* Baraldi, G. Add. 1883.1.

Morphology of the palatoquadrate in — Selachii. Allis, E. P. 1914.1. — *Dipnoi.* ★Boas, J. E. Add. 1914.1.

Fontanelles

In some fishes, certain skull bones such as the frontals and parietals fail to coalesce in the median line leaving open median pits or fontanelles.

These are fully discussed, in the skull of *Placoderms and Siluridae*, by ★Dean, B. 1891.2. This paper is reviewed by Woodward, A. S. 1891.9. — *Conditions in Callichthys.* Klinckowström, A. 1893.2.

The Jaws

Lesser papers on the homologies of the jaw elements throughout the vertebrate series. Albrecht, P. 1883.1, 1884.1; Bardeleben, K. 1905.1–1907.1; Broom, R. 1913.4; Humphry, G. M. 1865.1; Jourdain, S. 1878.1.

The sesamoid articular, a bone present in the mandible of some fishes. ★Starks, E. C. 1916.1; Storrow, B. 1910.2.

Minor papers descriptive of the jaws in the following forms. — *Amia and Hydrocyon.* Brühl, C. B. 1891.1. — *Cyprinus.* Freund, L. 1909.2. — *Esox and Teuthis.* Hilgendorf, F. M. 1872.1, 1880.1. — *Hemiramphus.* Hopewell-Smith, A. 1908.1. — *Gadus.* ★Petersen, H. 1914.1.

For figures of the jaws of various sharks and rays, see Garman, S. 1913.1, and Radcliffe, L. 1916.1.

Latero-sensory Canals

The latero-sensory canals of fishes, traversing certain cranial bones, are remarkably constant in position, and give important and often positive evidence as to the homologies of these bones. It is generally accepted that certain bones develop in direct relation to these canals. The en-

closure of the canals takes place in two distinct manners, called by Allis, plagiostomian and teleostean.

These matters, with the literature, are fully discussed in ★Allis, E. P. 1904.1.

An old paper on this subject is Stannius, F. H. 1842.3.

Morphology of the Myodome

The myodome of fishes, according to Allis, is primarily a sub-pituitary space connected with the orbit of either side or the orbital region by a canal which transmits the pituitary vein. This space secondarily acquired a wide communication with the orbits apparently by the enlargement of the eyeballs which caused a deepening of the orbits followed by the entry of certain eye-muscles into the pituitary canal and the final complete destruction by them of the wall separating the orbits from the subpituitary space. The myodome of *Amia* is believed to be strictly homologous (p. 193) with the cavernous and intercavernous sinuses and the Cava Meckelii, together, of the human skull.

This topic is comprehensively treated, with a full review of the literature, by ★Allis, E. P. 1909.1, pp. 183–203. See also Starks, E. C. 1905.2.

The Operculum

Much interest seems to have been exhibited, a century or more ago, in the morphological significance of the operculum. The following references, although not seen by us, seem to have little other than historical value.

Blainville, H. M. 1817.1,2; Bojanus, L. 1817.1; Eichwald, C. E. 1833.1; Geoffroy-St. H., E. F. 1817.1,2; Hollard, H. L. 1863.1, 1864.1; Lavocat, A. 1888.1; Oken, L. 1823.2. — *Operculum in Aspredinidae.* Eigenmann, C. H. 1892.8.

Suspensorium of Jaws

To express the manner in which the first visceral or mandibular arch is connected with the skull, Huxley (T. H. 1876.1, p. 40) suggested the terms *autostylic* where the mandibular arch is "attached directly to the skull by . . . its own substance;" *hyostylic* where the hyomandibular "becomes the chief apparatus of suspension;" and *amphistylic* for the "condition of the cranium which tends to connect the two [above] by a middle form."

Subsequent research has necessitated further precision in definition, which has been supplied, with additional terms, by ★Gregory, W. K. 1904.2.

Other papers relating to the suspensorium. Carter, J. T. 1905.1; Gadow, H. 1888.1; Huxley, T. H. 1859.1; Kerr, J. G. 1908.2; Pollard, H. B. 1895.2; and Swinnerton, H. H. 1902.1 (p. 568).

SKULL BY GROUPS

For the complete literature reference should be made also to "Skeleton" and to "Visceral skeleton."

Cyclostomata

The skull of this group consists entirely of the chondrocranium. It is highly specialized and its parts can not readily be homologized with those of the skull of other vertebrates.

Structure of the skull of Bdellostoma, Petromyzon, and Myxine. ★Allis, E. P. 1903.2; Neumayer, L. 1898.1; ★Schaffer, J. (*Myxine*) 1901.2; Schalk, A. 1913.1.

Dipnoi

Morphology of the skull of Dipnoi in general. Allis, E. P. 1914.2; ★Bridge, T. W. 1897.1; Brühl, C. B. 1891.3; Cobbold, T. S. 1862.3; ★Fürbringer, K. 1904.2; Boas, J. E. Add. 1914.1.

Development of the chondrocranium in —Lepidosiren and Protopterus. ★Agar, W. E. 1906.1. — *Neoceratodus.* Kravetz, L. 1911.1; Winslow, G. M. 1898.1; McGregor, J. H. Add. 1901.1.

Elasmobranchii

The Elasmobranchs "are sharply separated from all fishes except the Marsipobranchii, by the non-related condition of their exo- and endoskeleton" (Parker, W. K. 1879.2, p. 189). The skull is formed entirely by the chondrocranium. Calcification may occur in adult specimens but neither cartilage bones nor membrane bones develop.

Plagiostomi

The outstanding treatise on the Elasmobranch skull is the classical memoir (in German) of ★Gegenbaur, C. 1864.2 (iii).

An excellent general treatise in German is ★Hubrecht, A. A. 1876.3, p. 38 et seq.

Probably the most valuable memoir in English is ★Parker, W. K. 1879.2.

Development and morphology of the Selachian skull. Allis, E. P. 1913.1, 1914.1, 3; Kölliker, R. A. 1860.4; Rabl-Rückhard, H. 1880.1; Rosenberg, E. W. 1884.1, 1887.1; ★Severtzov, A. N. 1899.1; Wijhe, J. W. 1904.1.

Structure of the skull in —Chlamydoselachus. Cope, E. D. 1884.1, 1884.9. — *Pristidae.* ★Hoffmann, L. 1912.1. — *Ceratoptera.* Lloyd, R. E. 1908.2. — *Stegostoma.* ★Luther, A. F. 1909.1. — *Lamargus.* White, P. J. 1893.1.

For excellent figures of the skulls of various Plagiostomes, see Garman, S. 1913.1.

Holocephali

As may be inferred from the name "Holocephali," "the chimaeroid cranium, instead of developing as a uniform trough-like brain-case (shark), appears, even in early condition, in a wonderfully complete form; it incloses the hind-brain, the forebrain, and the nasal region." (Dean, B. 1906.1, p. 127.)

Structure of the skull of Holocephali. Brühl, C. B. 1891.3; Hubrecht, A. A. 1876.1; ★Luther, A. F. 1909.1; Reis, O. M. 1895.2; ★Schauinsland, H. H. 1903.1.

SKULL OF TELEOSTOMI**Crossopterygii**

In Polypterus, the chondrocranium is largely persistent. The sphenoid bone, according to Bridge (p. 126), is strictly homologous with the sphenethmoid of the Amphibia. No Ganoids other than Polypterus and Calamoichthys have a sphenethmoid of the Polypterus or Amphibian type.

"Polypterus," says Pollard (p. 405), "will be the most suitable type to explain the origin of perichondrial [cartilage] bones."

Morphology of the skull of Polypterus. Allis, E. P. 1900.2; Bridge, T. W. 1890.3;

Budgett, J. S. 1902.2; Owen, R. 1863.1; ★Pollard, H. B. 1892.2; Traquair, R. H. 1871.3.

Morphology in Calamoichthys. Supino, F. 1914.2.

Chondrostei

Homologies of cranial bones of Polyodon. Allis, E. P. 1903.3; Bridge, T. W. 1878.1.

Development and morphology of the skull of Acipenser. Luther, A. F. 1913.1; Maggi, L. 1899.1; ★Parker, W. K. 1873.1, 1881.1.

Holostei

Morphology, development, and homologies of bones of the skull of Amia and of Lepidosteus. ★Allis, E. P. 1897.1, 1898.3, 1899.2; Bridge, T. W. 1877.1; ★Parker, W. K. 1882.1; ★Sagemehl, M. 1884.1; Schreiner, K. E. 1902.1; ★Veit, O. 1907.1, 1911.1.

Teleostei

Additional references to the skull of Teleosts will be found under Skeleton, below the caption "Osteology of Teleostei."

Sub-order Acanthopterygii

Cranial anatomy of the mail-cheeked fishes, Loricati or Scorpænoidea. ★Allis, E. P. 1907.1, 1909.1.

Cranial anatomy of Scomber. ★Allis, E. P. 1903.4; Dewitz, J. 1904.1.

Skull of Pleuronectidae. Brühl, C. B. 1891.5; ★Cole, F. J. & Johnstone, J. 1901.1; Klein, E. E. 1868.1. — *For changes in skull of flatfishes during metamorphosis and rotation of eye, see under Pleuronectidae in the Systematic Section.*

Structure of the skull of —Anarrichthys. Adams, L. A. 1908.1. — *Regalecus.* Benham, W. B. & Dunbar, W. J. 1906.1. — *Labrax.* Brühl, C. B. 1891.5. — *Sebastodes.* Cramer, F. 1895.1. — *Cyclopterus and Liparis.* Hilgendorf, F. M. 1878.1. — *Lucioperca.* Pugliesi, E. 1911.1. — *Echeneidae.* Regan, C. T. 1912.2. — *Ruvettus.* Supino, F. 1901.1 (iii). — *Trichiuridae.* Supino, F. 1904.3.

Cranial characters (taxonomic) of Sparoid genera Calamus, Diplodus, Archosargus, and Stenotomus. Gill, T. N. 1883.1, 3.

Structure of the skull respectively of Pomatomus and Hoplostethus; Percidae and Triglidae; and Trachinidae. Supino, F. 1901.1 (iv), 1904.3, 1908.3.

Sub-order Apodes

Skull of Muraenidae. Cannarella, P. 1898.1; Ficalbi, E. 1886.1; Jacoby, L. 1867.1.

Skull of —Anguilla. Parker, W. K. 1871.2. — *Amphipnous.* Regan, C. T. 1912.1. — *Gastrostomus.* Zugmayer, E. 1913.1.

Sub-order Haplomi

Skull of —Esox. Arendt, E. 1822.1; ★Walther, J. K. 1883.1; Csengő, N. Add. 1914.1. — *Scopelus.* Supino, F. 1901.1 (i).

Skull — Cont'd.

Sub-order Malacopterygii

Skull of Mormyridæ. Erdl, M. P. 1847.1; Pappenheim, P. 1907.1; Ridewood, W. G. 1904.2.

Skull of Osteoglossidæ. Bridge, T. W. 1895.1; Ridewood, W. G. 1905.2.

Skull of Salmonidæ. (See also above under "Development.") Boulenger, G. A. 1895.10; ★Parker, W. K. 1872.1.

Structure of the skull of — Alepocephalus. Gegenbaur, C. 1878.4. — *Albula.* Gill, T. N. 1907.6. — *Aulastomatomorpha.* Lloyd, R. E. 1906.1. — *Chauliodus.* Supino, F. 1901.1 (i).

Cranial osteology respectively of Elopidae and Albulidae; Notopteridae and Hyodontidae; Clupeidae; Pantodontidae and Phractolaemidae; and Gonorhynchidae. Ridewood, W. G. 1904.1, 2, 1905.1, 2, 3.

Sub-order Ostariophysi

Skull of Characinidae and Cyprinidae. Jaquet, M. 1902.1; ★Sagemehl, M. 1884.1; Gervais, F. L. Add. 1850.1.

Skull of — Siluridae and Loricariidae. Dean, B. 1891.2. — *Loricaria.* Goeldi, E. A. 1884.1. — *Siluridae.* Neumayer, L. 1908.1. — *Clarias.* Schelaputin, G. 1906.1. — *Hypophthalmus.* Wright, R. 1886.1.

Skulls of fishes
of various sub-orders

Lota. Bonsdorff, E. J. 1845.1. — *Exocoetus.* Lasdin, W. 1913.1, 2. — *Syngnathus.* McMurrich, J. T. 1883.1. — *Lyomeri (Taxonomic relations).* Regan, C. T. 1912.5. — *Macrourus.* Supino, F. 1901.1 (ii). — *Lophobranchii.* Supino, F. 1904.3. — *Pediculati and Plectognathi.* Supino, F. 1904.3, 1908.3. — *Trachinidae.* Supino, F. 1908.3. — *Lophius.* Morrow, R. Add. 1882.1.

SLEEP OF FISHES

For the so-called "summer," and "winter sleep" of fishes, see respectively under *Aestivation, and Hibernation.*

Comments, notes, observations, and miscellaneous items on sleep in fishes, the question whether fishes do sleep, etc. Bonvoisin, L. 1877.2; Capel, C. C. 1878.1; Eisig, H. 1883.2; Hughes, W. R. 1874.1; Reinhart, H. 1911.1–1913.1; Reuss, H. 1911.1; Schmid, B. 1911.1; Schulze, L. 1913.2; Shufeldt, R. W. 1900.3; Verrill, A. E. 1897.1; Fraenkel, F. Add. 1909.1; Krüger, B. Add. 1914.1; Voigt, G. Pre-Linn. 1721.1.

Observations on the position of fishes during sleep. Carazzi, D. 1913.2; Krüger, B. 1913.8; Leeke, — 1912.1; Möbius, K. A. 1867.1; Romeis, B. 1911.1; Werner, Franz 1911.1.

Experiments with special apparatus indicate greater activity during the day, with periods of repose at night. Polimanti, O. 1911.2; ★Szymanski, J. S. 1914.1.

SMELL (OLFACTORY SENSE)

For the structure of the organs of smell, see *Olfactory organs.*

For a résumé of our knowledge on the sense of smell in fishes, see ★Parker, G. H. & Sheldon, R. E. 1913.1.

Researches on the olfactory sense of fishes; necessary distinctions between smell and taste and a common chemical sense, etc. (Conclusions that olfactory sense exists; in dogfish (*Mustelus*) this is lost when nostrils are plugged with cotton.) Parker, G. H. 1910.3, 1911.1, 2, 1912.1, 1914.1, 2; Sheldon, R. E. 1909.3, 1911.1; Parker, G. H. & Stabler, E. M. Add. 1913.1.

Existence of the sense of smell in — Balistes. Baglioni, S. 1909.2, 1910.1, Add. 1909.1. — *Spheroides.* Copeland, M. 1912.1. — *Cyprinus.* Herklotz, E. O. 1864.1.

Conclusion that fishes do not possess a sense of smell. Nagel, W. A. Add. 1894.1.

Miscellaneous papers on the olfactory sense in fishes. Desvignes, — 1835.1, 1836.1; Doflein, F. J. 1911.1; Duméril, A. M. 1807.3, 1858.1; Fohmann, V. 1835.1; Geoffroy-Saint-Hilaire, E. F. 1825.1; Kammerer, P. 1911.1.

SOUND PRODUCTION AND SOUND PRODUCING ORGANS

For an analysis of the methods of sound production by fishes, see Bridge, T. W. 1904.1, pp. 355–365.

Sound production. General treatises. Dufossé, A. 1874.1; Sørensen, W. E. 1884.1.

General researches on sound production. Dufossé, A. 1858.1, 1866.1, 1868.1, 1872.1; Duméril, A. H. 1863.2; Robin, C. P. 1872.1, 2; ★Müller, J. 1857.1; ★Weiss, O. Add. 1914.1.

Apparatus of sound production.

— *Extrinsic muscles of air bladder producing sounds.* Bridge, T. W. & Haddon, A. C. 1894.1; Skomorowski, T. 1875.1; ★Sørensen, W. E. 1879.1, 2, 3, 1895.1; Tower, R. W. 1908.1; Bridge, T. W. Add. 1893.1.

Muscles forming a diaphragm inside air bladder. Moreau, F. A. 1864.2, 1876.3.

Stridulating apparatus, producing sounds by grating of spines against parts of skull, etc. — *Balistes.* Möbius, K. A. 1889.1. — *Callomystax.* Haddon, A. C. Add. 1881.1.

Miscellaneous papers including popular accounts, etc., on "musical fishes," "song of fishes," "voice," etc.

Text in Dutch. Harting, P. 1862.2, 1874.1, 1880.3; Lubach, D. 1859.1, 1872.1.

Text in English. Abbott, C. C. 1877.1, 1884.1; Cobb, J. N. 1908.4; Evermann, B. W. 1909.1; Galton, J. C. 1874.1; Gill, T. N. 1881.3; Girard, C. F. 1889.2; Holder, C. F. 1902.1; Parish, C. 1871.1; Spicer, W. W. 1871.1; Tower, R. W. 1906.1; Günther, A. C. Add. 1870.1; Kingsley, M. H. Add. 1901.1; Thompson, J. Add. 1830.1; Athenæus, N. Pre-Linn. 1680.1; Anon. 368, 506.

Text in French. Coupin, H. 1904.1; Santini, E. 1898.1, 1899.1.

Text in German. Landois, H. 1873.1; Martens, E. 1876.2; Mettenheimer, C. F. 1858.1; Sinroth, H. R. 1897.1; Anon. 262, 369, 370, 505.

Text in — Spanish. Balaguer y Primo, D. F. 1878.1. — *Finnish.* Wikström, D. A. 1889.1. — *Swedish.* Zur Mühlen, M. 1911.7.

Sound production by various fishes.

— *Sciænidæ*, including *Drumfish*. Adams, A. 1861.1, Add. 1848.1; Agassiz, J. L. 1850.4; Smith, H. M. 1905.1. — *Siluridæ*. Agassiz, J. L. 1850.4; Brüning, C. 1913.4; Jenyns, L. 1842.1; Jobert, C. 1880.1; Maas, K. 1914.1. — *Misgurnus*. Budge, J. 1873.1. — *Perch*. Hamilton, W. R. 1889.1. — *Barbus*. Peal, S. E. 1880.1. — *Purring gourami*, *Ctenops*. Schäfer, P. 1915.1; Schiebold, A. 1912.1; Dorn, R. Add. 1914.1. — *Herring*. Murray, J. Add. 1831.1, 1833.1.

Sound producing fishes of various localities. — *Singing fish of Batticaloa, Ceylon*. Driberg, C. 1908.1; Newman, E. 1860.1; Pearson, J. 1912.3. — *Musical fishes of Borneo*. Anon. 603; Beccari, O. Add. 1904.1; St. John, S. Add. 1844.1.

Musical fishes of South America. Lubach, D. 1862.1; Onffroy de Thoron, E. V. 1866.1; Thoron, O. de 1861.1, 1870.1; Tesson, A. Add. 1884.1.

SPERMATOOZOA

For the female reproductive elements, see Ova and ovum. For Fertilization and related topics, see under Embryology.

Discovery of spermatozoa (in codfish). Leeuwenhoek, A. Pre-Linn. 1702.1.

Behavior or movements of the spermatozoa of fishes: The characteristic rheotropism (upstream) of the mammalian spermatozoön is absent in the sperm of ordinary oviparous Teleosts having external fertilization, in which the sexual products are simply cast into the water, and where such rheotropism would be of no value, as shown by the careful researches of Adolphi, H. 1906.1.

Chemical composition. For an exhaustive treatise on the chemistry of spermatozoa, with a full bibliography, consult ★Burian, B. in *Ergebnisse der Physiol.*, (Asher u. Spiro), 1904, 3. Jahrg., 1 Abt., 48–106; 1906, 5. Jahrg., 1 Abt., 768–846.

Early researches on chemistry of spermatozoa. Baumhauer, E. H. 1846.1; Fourcroy, A. F. & Vauquelin, L. N. 1807.2; Gobley, — 1851.1.

General discussion of proteins of spermatozoa. ★Kossel, A. Add. 1913.1.

Histones: basic proteins intermediate between protamines and true proteins. — *Scombron of mackerel sperm.* Bang, I. 1899.1. — *Lotahistone of Lota.* Ehrström, R. 1901.1. — *Centrophorus histone.* Kossel, A. 1907.1. — *Gadushistone of cod.* Kossel, A. & Kutscher, F. 1900.1.

Protamines: designated by Kossel as the simplest proteins, found only in combination with nucleic acids in spermatozoa of fishes. Various papers, chiefly on salmine of salmon sperm. Dezani, S. 1908.1; Kurajeff, D. 1899.1, 1901.1; Malenück, W. D. (*Sturine*) 1908.1; ★Miescher-R., F. 1881.1, 1896.1, Add. 1897.1; Piccard, J. 1874.1; Weiss, F. 1907.1; Zacharias, E. O. 1898.3; Schmiedeberg, O. Add. 1899.1. — *Discovery of protamines.* Miescher, F. Add. 1874.1.

Cleavage products — Agmatine derived from hydrolysis of herring sperm. Kossel, A. 1910.1. — *Purine bases: adenine, guanine, and sarkine or hypoxanthine.* Levene, P. A. & Mandel, J. A. 1906.1; Piccard, J. 1874.1; Schindler, S. 1889.1.

Duration of virility. *Effects of radium.* Oppermann, K. 1913.1. — *Effects of temperature, chemicals, bile of Anguilla, etc., on shark sperm.* Trois, E. F. 1883.2.

It is now well known, chiefly through the experiments of Quatrefages and of Henneguy, that the life of the spermatozoa of freshwater fishes, after their expulsion into the water at the time of fertilization, is very short, being not more than one minute in the trout, according to Henneguy. These experiments were made for the fish-culturists, who, now, in order to prolong the virility of the sperm, generally avoid mixing the milt with water when fertilizing the eggs. *References as follows:* Henneguy, L. F. 1877.1; Quatrefages, J. L. 1853.1. — *Review of subject including marine fishes.* ★Reighard, J. E. 1893.2. — *Exps. with salmon sperm.* Rutter, C. 1902.1, 1904.1.

Retention of virility in salmon milt when unmixed with water. Atkins, C. G. 1874.1, 1879.1; Simmonæs, J. O. 1896.1. — *Virility retained after 21 hours in transit.* Calderwood, W. L. 1909.1.

Vrasski, V. P. claimed such endurance up to six days. (Cf. acc't in Vœlkel, P. 1870.1.) He originated the "Russian, or dry method of impregnation." — For this method, see Artificial fertilization, under Pisciculture.

Masses of spermatozoa or spermatophores. *Spermatophores (said to possess an external investing membrane) of the oviparous Chimæroid, Callorhynchus.* Parker, T. J. 1892.1.

Sperm aggregations of the viviparous Pæciliidæ, lacking an external membrane. Philippi, E. 1907.1, 1908.1. — *Summary of this.* Henn, A. W. 1916.1.

For related topics, such as manner of copulation, etc., see Viviparity under Reproduction.

Spermatogenesis. *Miscellaneous and general.* Ovsiyannikov, F. V. 1869.1; Popoff, N. 1909.1. — *Nurse or Sertoli cells, functions.* Peter, K. 1898.1; Stéphan, P. 1902.2, 4, 5.

Spermatogenesis in — Lepidosiren. Agar, W. E. 1911.1, 1912.1. — *Myxine.* Cunningham, J. T. 1892.6; ★Schreiner, A. &

Spermatozoa — *Cont'd.*

Schreiner, K. E. 1905.1, 1906.1. — *Chimæra*. Stéphan, P. 1903.1.

Spermatogenesis in Elasmobranchs, chiefly Selachii. Hallmann, E. 1840.1; Hermann, F. 1897.1, 1898.1; Hermann, G. 1881.1; La Valette, St. G., A. 1878.1; ★Moore, J. E. 1895.1; Rawitz, B. 1898.1; ★Sabatier, C. P. 1882.1, 1895.1, 1896.2; Sanfelice, F. 1888.1; Schreiner, A. & Schreiner, K. 1906.1; Semper, C. G. 1875.3; Stéphan, P. 1902.2, 4, 1903.2. — *Middle piece, origin.* Suzuki, B. 1899.1.

Early work on the origin of spermatozoa in Selachii. Hallmann, E. 1840.1; Lallemand, F. 1841.1; Martino, A. 1846.1, 1848.1.

Development of atypical or teratological forms in Selachii. Broman, I. 1902.1; Stéphan, P. 1902.3.

Structure of spermatozoa. *Shape, size, etc., of mature or functional spermatozoa of various fishes.* ★Ballowitz, E. 1890.1. — *Amphioxus.* Bert, P. 1866.2. — *Petromyzon.* Ballowitz, E. 1905.2; Bory de Saint-Vincent, J. B. 1822.2; Gulliver, G. 1875.2. — *Carp.* Dujardin, F. 1837.1. — *Elasmobranchii.* ★Retzius, M. G. 1902.1, 1909.1. — *Leptocardii, Teleostei, and Ganoidei.* Retzius, M. G. 1905.2.

SPINAL CORD

Much additional literature on the spinal cord, which it has not been practicable to separate from that relating to the brain, will be found under the heading "Central nervous system" under Nervous system. See also Brain.

Generalia. — "Lateralstränge," *Teleosts.* Haller, B. 1910.1. — *Preservation of spinal cord in fossil fishes.* Reis, O. M. 1894.2. — *Circulatory system of spinal cord, development and comparative anatomy.* ★Sterzi, G. 1904.1.

Anatomy and morphology. *Miscellaneous and general.* Kölliker, R. A. 1858.1; Mauthner, L. 1859.1.

Amphioxus. Stendell, W. 1914.3; Wolff, M. 1907.1.

Cyclostomata (Ammocætes and Petromyzon). Carus, C. G. 1828.1; Freud, S. 1879.1; ★Kolmer, W. 1905.2; Ovsyannikov, F. V. 1864.3, 1903.1; Reissner, E. 1860.1; ★Tretjakoff, D. 1909.2.

Plagiostomi. ★Kalberlah, F. 1900.1. — *Pristiurus and Rays.* Lenhossék, M. 1892.1, 1894.2; Retzius, M. G. 1895.3; Stieda, L. 1871.1, 1872.2, 1873.4. — *Myliobates.* Schacherl, M. 1902.1.

In Teleostomi. ★Haller, B. 1895.2, Add. 1896.1; Ovsyannikov, F. V. 1864.3. — *Orthogoriscus mola.* ★Haller, B. 1891.1; Tagliani, 1894.1, 1895.1. — *Carassius.* Hirsch, J. 1912.1. — *Mormyridæ.* ★Marcusen, J. 1864.1. — *Acipenser.* Pavlovskii, E. 1895.1. — *Esox.* Stieda, L. 1861.1. — *Anguilla.* Tiegel, E. 1878.1. — *Lophius.* Wyman, J. 1854.1, *Cyclopterus.* 1854.4. — *Trigla.* Rejsek, J. Add. 1898.1.

Anatomy of particular parts or structures of the spinal cord. *Accessory lobes in* — *Prionotus.* Herrick, C. J. 1907.3. — *Teleostei.* ★Usov, M. M. 1886.1.

Terminal portion of spinal cord, relation to notochord in — *Amphioxus.* Lvov, V. N. 1893.2. — *Amphioxus, Myxine, and Petromyzon.* Retzius, M. G. 1891.1, 1892.2, 1895.2. — *Vertebrates in general.* Schwarz, D. 1889.1; Studnička, F. K. 1895.3; Henneguy, L. F. Add. 1882.1. — *Caudal intumescence (source of filum terminale).* Rauber, A. 1876.1. — *Terminal ganglion, Cyprinus.* Weber, E. H. 1827.3.

Development and origin. — *Cells in anterior roots.* Debeyre, A. 1907.1. — *Posterior nerve roots in Petromyzon.* Freud, S. 1877.2. — *Development of spinal cord, Amphioxus.* Wolff, M. 1907.1.

For early stages in the formation of the spinal cord, see Formation of embryo, and Medullary tube under Embryology.

Histology and histogenesis. Ovsyannikov, F. V. 1854.1; Retzius, M. G. 1893.2; ★Studnička, F. K. 1895.2. — *Cells for light perception.* Boeke, J. 1902.2. — *Subpial layer.* Nemiloff, A. 1912.1. — *Intersection of nerve fibers.* Vulpian, E. F. 1864.2.

Histology and histogenesis in various fishes. — *Tinca.* Jacobsohn, L. 1911.1. — *Teleosts.* ★Kolster, R. 1898.1. — *Orthogoriscus.* Paladino, G. 1913.1. — *Trout.* ★Gehuchten, A. 1895.1; Rohon, J. V. 1884.1.

Giant ganglion cells (Rohon-Beard cells) in spinal cord of — *Heterosomata and Pterophryne.* Dahlgren, U. 1897.1, 1898.1. — *Trutta.* Gehuchten, A. 1896.1. — *Coregonus and Catostomus.* Johnston, J. B. 1900.1. — *Perca.* Kolster, R. 1898.2. — *Selachii.* Neal, H. V. 1911.1. — *Ctenolabrus.* Sargent, P. E. 1898.1, 2. — *Amphioxus and Solea.* Tagliani, G. 1897.1, 1898.1.

"Hinterzellen" in fishes. Gehuchten, A. 1897.1.

Mauthner's fibers in — *Salmo.* Beccari, N. 1908.1. — *Teleostei.* Kolster, R. 1898.3; Marano, A. 1911.1. — *Chimæra.* Solger, B. F. 1899.1. — *Anamnia.* ★Tagliani, G. 1905.1.

Physiology, normal and experimental. Bickel, A. Add. 1897.1, 1900.1. — *Rate of nervous impulses in spinal cord Bdellostoma.* Carlson, A. J. 1904.2. — *Experiments to ascertain influence on heart action.* Clift, W. 1815.1.

SPLEEN

Anatomy. General accounts. ★Phisalix, C. 1885.1; Rathke, M. H. 1837.2.

Anatomy in — *Amiurus.* Mackenzie, T. 1884.1. — *Petromyzon.* Mayer, A. F. 1832.1. — *Selachii.* Neuville, H. 1898.1. — *Anguilla.* Phisalix, C. 1883.1.

Development. General researches. ★Choronshitsky, B. 1900.1; Kupffer, C.

W. 1892.1; ★Piper, H. 1902.2; Poso, O. 1906.1.

Development in — Teleosts. ★Laguesse, G. E. 1887.1, 1890.2. — *Ceratodus*. Neumayer, L. 1904.1, 3. — *Acipenser*. Nicolas, A. 1904.1. — *Amia*. Piper, H. 1902.1, 3, 1903.1. — *Selachii*. Ruffini, A. 1904.1.

Histology. Hoyer, H. 1892.1. — *Of spleen capsule, Selachians*. Laguesse, G. E. 1903.1, 2, Add. 1888.1.

Physiology. ★Whiting, A. J. 1897.1; Phisalix, C. 1885.1. — *Changes undergone in salmon spleen while in freshwater*. Miescher-Ruesch, F. 1881.1. — *Role in formation of blood*. Phisalix, C. 1902.1.

Physiological effects of removal. — *Tissue hyperplasia following removal of spleen*. Drzewina, A. & Pettit, A. 1904.1. — *Fusiform cells, occurrence in blood after removal of spleen*. Pettit, A. 1904.2, 3.

SUPRARENAL ORGANS (SURRENAL SYSTEM OF FISHES)

Including the "Interrenal body" (or cortical tissue), and the "Suprarenal bodies" (medullary tissue) or Chromophile bodies.

It is now well established that the mammalian adrenal or suprarenal organs, represented by an asymmetrical pair of bodies which surmount the kidneys, each of which is composed of a central medullary tissue and an outer cortical tissue, are represented in fishes by two morphologically independent structures. The determination of these homologies has been a matter of gradual growth but is largely due to Swale Vincent.

Introductory

Because of the importance of the subject from the medical standpoint, the structure and especially the functions of the suprarenals, in all groups of vertebrates and especially in the mammals, has, in recent years, been made the subject of profound and exhaustive inquiry. The number of titles of such researches, included in the bibliographies of the general works about to be mentioned, mounts into the hundreds.

In order to properly orient the following account, which pertains exclusively to fishes, reference may advantageously be made to the following general summaries of our present knowledge of the suprarenal system, which include also much material on fishes.

These are ★Artur Biedl's "Innere Sekretion" and its English translation, and ★Swale Vincent's "Internal Secretions and the Ductless Glands."

Principal literature

The most recent summary (in German), of the morphology and development of the suprarenal system in vertebrates, with extensive bibliography, is ★Poll, H. 1906.1.

For the best papers in English, although somewhat obsolete, see ★Vincent, Swale 1896.1–1907.1. An excellent historical résumé and numerous outline drawings of these organs in various fishes are given in ★Vincent, S. 1898.1.

Historical résumé

In man, the suprarenals were first recognized as separate organs, by Eustachius, in the year 1563.

"The earliest account respecting these bodies in fishes [quoting from Collinge & Vincent, 1897.1, with necessary adaptations in reference numbers] is that given in 1819 by Retzius (A. A. 1819.1) who described them in certain species of dog-fish and skate. Stannius in 1839 (1839.2) discovered similar bodies in teleostean fishes, and in 1846 (1846.2) he gave a general account of them in elasmobranchs, teleosts, and the sturgeon. [They have been subsequently very generally known as the "Corpuscles of Stannius."] In the same year Ecker verified Stannius' observations and gave a description of the minute anatomy of the bodies. Hyrtl (C. J. 1851.2) and Leydig (F. Add. 1851.1) contributed further papers to the subject, the former dealing with teleosts, and the latter with *Chimæra*.

"In 1852 Frey published a general résumé of what was known of these bodies, in Todd's Cyclopaedia. Leydig in 1852 (1852.1) pointed out their segmental arrangement; and a further contribution was made by Stannius. In 1875 Semper (C. G. 1875.3), in a very valuable paper, emphasised the importance of the segmental arrangement. F. M. Balfour in 1878 (1878.1) gave an account of the morphology and development of the suprarenal bodies in elasmobranchs in his well known 'Monograph.' It is to this writer that we owe the term 'interrenal.' A description of the suprarenals of *Amiurus* was published by M'Kenzie in 1884 (T. 1884.1)."

An early paper, not seen by us, is Jacobson, L. L. 1828.1.

Suprarenal organs of Elasmobranchii

It was in this group that the two distinct sets of structures which have been called "suprarenals" were first distinguished.

The one type, first noticed by Retzius (A. A. 1819.1), who called it a "suprarenal" because of its resemblance in texture to the suprarenal of birds, "is an 'ochre-yellow' rod-shaped structure, paired in the Rays, unpaired in the Sharks, lying usually in the region of the posterior part of the kidney but sometimes extending as far forward as its anterior extremity" (Vincent, S. 1898.1, p. 53).

Somewhat later, Leydig (F. 1852.1) insisted that the so-called axillary hearts of Duvernoy (G. L. 1837.1) and their continuations on the sympathetic ganglia were the true suprarenals. These segmentally arranged bodies described by Leydig are, in the words of Vincent, "paired bodies, placed on the intercostal or parietal branches of the aorta, and extending in many cases throughout the whole length of the abdominal cavity."

Balfour in order to distinguish the two sets of structures applied the term "interrenal" to the first and limited the term "suprarenal" to the segmentally-arranged bodies. He believed that he could distinguish medulla and cortex in the latter and was inclined to view the "suprarenals" as homologous with the mammalian suprarenal.

It is now almost generally admitted that the mammalian suprarenal is a compound organ, of which the medullary (or chromophile tissue) is derived from or is homologous with the paired segmental bodies, while the cortical tissue is homologous with the interrenal bodies.

The determination of these homologies we owe largely to Vincent. From its histological appearance, he noted (1898.1, p. 79) the resemblance or "analogy" of the interrenal tissue of Elasmobranchs to the mammalian cortical tissue and concluded that it possessed a "secretory nature." About the same time, but quite independently, Diamare (V. 1899.1) reached almost identical conclusions.

When referring, at one time, to the probability of the correspondence of the interrenal

Suprarenals — Cont'd.

to the cortex of the mammalian suprarenal (Vincent, S. 1897.1, p. 46), Prof. Schäfer suggested that the matter be tested physiologically as given below under "Physiological action." The results, as there indicated, firmly established these homologies.

Development of the suprarenals

It is now well established that the chromophile (medullary) bodies and the interrenal (cortical) tissue are of different embryonic origin, the former, as first established by Balfour (F. M. 1878.1), being derivatives of the sympathetic ganglia, and the latter arising from thickenings of the coelomic epithelium (Wijhe, J. W. van 1889.1).

The most valuable recent summary of the development of the suprarenal organs in vertebrates, with a full review of the previous literature, is ★Poll, H. 1906.1.

Other papers on their development or morphology in Elasmobranchii. Diamare, V. 1899.1, 1905.1; ★Grynfeldt, E. 1902.1, .2, .3, 1903.1, 1903.2; Kohn, A. 1898.1, 1899.1; ★Minervini, R. 1904.1; Wijhe, J. W. 1888.1, .2, 1889.1; and Zuckerkandl, E. 1906.1.

Others relating to Teleosts. Diamare, V. 1895.1, 1899.1; Huot, A. 1897.1, 1898.1; Pettit, A. 1910.1; and Srdinko, O. V. 1903.1 (i).

Fallacious theories of development

In 1827, Rathke (M. H. 1827.1) put forward the view that possibly the pronephros of Cyclostomes represents the suprarenal bodies of the Gnathostomata. Evidently quite independently, Weldon (W. F. 1884.1, .2) after a study of the pronephros of *Bdellostoma*, reiterated these views. Groslik (S. 1885.1) developed a somewhat similar view, considering the "head-kidney" of Teleosts to consist of two parts, the degenerated pronephros and the cortical part of the suprarenals. These views have been fully discussed by Collinge & Vincent (1896.1) and by Vincent (S. 1898.1) who believe that there is no relation, other than that of position, between the suprarenal organs and the renal organs.

More recently, Aichel (O. 1900.1, .2), who homologizes the Selachian interrenal alone with the mammalian adrenal, has derived both parts of the mammalian adrenal from the mesonephric nephrostomes. However, it is now generally stated (Poll) that there is no relation between the renal and suprarenal organs.

Suprarenal organs of other groups**Histology of the suprarenals**

The medullary substance possesses a decided chromaffinity, and when treated with salts of chromic acid (potassium bichromate), it takes on a deep yellow or brown coloration due to the presence of adrenalin. Because of this distinctive reaction, the medullary substance has been termed "Chromophil" (Stilling); "Chromaffin" (Kohn) and "Phaeochrome" tissue (Poll, 1906.1, p. 444). As applied to fishes, this method seems to have been first used by Semper (C. G. 1875.3, p. 228).

The coloring substance, because of its lipid content, on treatment with osmic acid, gives a characteristic black color. This method seems first to have been used, with fish material, by Chevrel (R. 1890.1).

By the use of these characteristic stains, Giacomini has successfully demonstrated the occurrence of chromophile (medullary) and interrenal (cortical) tissue in all classes of fishes.

Suprarenal organs of Cyclostomata

Giacomini (E. 1902.1, 1904.2), using the chrome reaction to identify the tissues, demonstrated the existence of chromophile tissue as a row of small bodies extending along the aorta and its lateral branches from the second branchial to the end of the post-anal regions. The interrenal (cortical) tissue consists of scattered islets, often composed of only two or three cells, which lie in the tissue on the lateral and ventral aspects of the cardinal veins.

Gaskell (J. F. 1912.1) has since confirmed the existence of chromophile tissue by physiological methods (*see below*), since extracts of this tissue produce a characteristic rise of blood pressure in the cat, which can be matched by measured adrenalin injections.

Suprarenal organs of Teleostomi

Extending his researches, Giacomini has since demonstrated the presence of chromophile and interrenal tissue in Teleosts (1902.3); Acipenser (1904.1); Amiurus (1905.1); both larval (*Leptocephalus*) and adult eel (*Anguilla*), 1908.2, .4, 1909.3; *Salmo* (1910.1, 1911.1); Cyprinidae (1911.2); Lophobranchii (1911.3), etc.

In general, interrenal tissue is found in the "Corpuscles of Stannius," which are small bodies, either paired or unpaired, situated at the posterior end of the kidney, and also (*Anguilla*, *Esox*, *Tinca*, *Trutta*) in the "anterior interrenal organ" which is a single body situated at the anterior edge of the pronephros and attached to the anterior and posterior cardinal veins.

Chromophile tissue cells occur in the walls of the cardinal veins, and also distributed between the lobes of the anterior interrenal organ.

Mulon (P. 1914.1) has examined chemically the anterior interrenal organ of Teleosts and finds it apparently devoid of pigment and cholesterol, thus differing profoundly from other vertebrates. However, the cytological details are essentially similar and he concludes that it is homologous with the mammalian cortex.

Suprarenal organs of Dipnoi

Giacomini (E. 1906.1) has also demonstrated the presence of chromophile cells in *Protopterus*, grouped into small paired bodies attached to the intercostal arteries throughout the trunk region, also in the walls of the posterior cardinal vein and the left azygos vein. No trace of interrenal tissue could be found.

Physiological action of suprarenal tissue

It is now well known, through the researches of Oliver and Schäfer (*Journ. Physiol.*, 1895, vol. 18, p. 230) and of others, that saline extracts of the suprarenal capsules when injected into the blood vessels of a living animal, produce definite and characteristic results, shown especially by a marked rise in blood pressure. The extract of the medulla only acts in this way, the cortical substance being practically inactive. The active principle of the medullary or chromophile tissue extracts has subsequently been isolated as epinephrin or adrenalin.

Using this principle, Vincent (S. 1897.1) showed that filtered saline extracts of the segmentally arranged "suprarenals" of Elasmobranchs (*Scyllium* and *Acanthias*) contracted the blood vessels of the toad to an enormous degree while extracts of the interrenals and of the Teleostean "suprarenals" produced no effect. He thus concluded that the segmental bodies are homologous with the medullary tissue of the mammalian suprarenal while the interrenal corresponds to the mammalian cortical tissue.

Vincent (S. Add. 1897.1) later demonstrated that injection of the extract of the paired seg-

mental bodies of Elasmobranchs profoundly influences the blood pressure in dogs and cats, while extracts of the interrenal tissue are without effect. These results have been confirmed by Biedl & Wiesel (Archiv. f. d. ges. Physiol., 1902, vol. 91, pp. 434-461).

Functions of the suprarenals

Brown-Séquard in 1856 first showed that removal of suprarenals in mammals is followed by death, usually in two or three days, and that the symptoms preceding death are those of extreme muscular prostration. This likewise seems to be the case with fishes.

Vincent (S. 1898.3,4) has extirpated the "suprarenals" (i. e. the interrenal or cortical tissue) in the eel. One specimen survived 28 days after the operation; another 64, and a third was killed on the 119th day. From these results, he assumed "that the cortical gland is not absolutely essential to the life of the animal."

A compensatory hypertrophy of the remaining "suprarenal," after one had been removed from an eel, has been described by Pettit (A. 1896.2).

The results of Vincent and of Pettit have subsequently been invalidated by the discovery in the eel by Giacomini (E. 1908.2) of additional interrenal tissue situated at the anterior edge of the pronephros and attached to both the anterior and posterior cardinal veins.

Contrary to the results of Vincent, Biedl (A. 1912.1) found that in the skate (Torpedo and Raja), if the interrenal body is removed, the fishes grow progressively weaker after about a week and become much paler in color, scarcely moving and refusing all food after from 14 to 18 days. They usually died within three weeks after the operation with all the symptoms of general prostration.

TACTILE ORGANS (INCLUDING SENSE OF TOUCH)

See also Lateral line system, Senses and Sense Organs.

Structure and function. ★Jobert, C. 1871.1, 1872.1, 1873.1. — Acipenser. Ovsyannikov, F. V. 1872.3.

Physiology of organs of touch. Baglioni, S. 1909.2, 1910.1, Add. 1909.1.

Barbels. Numerous unrelated species of fishes possess filiform tactile processes (barbels) on either dorsal or ventral or both lips.

References to the structure or functions of the barbels have appeared for the following forms. — Peristedion. Jourdan, E. 1890.1. — Mullus. Lo Bianco, S. 1907.2. — Siluroids. ★Pollard, H. B. 1905.1. — Polyodon. Wagner, G. 1904.1. — Mullus, Motella, Blennius, and Trigla. Zincone, A. 1876.1.

Fins of Motella used as feelers. Bateson, W. Add. 1890.1.

Oral cirri or tentacles of Amphioxus. Klaatsch, H. 1898.2.

Supra-orbital tentacles of Blennius. Baylis, H. A. 1914.1.

TASTE (GUSTATORY SENSE)

For the structure of the organs of taste, see Gustatory organs.

For the most comprehensive works on the sense of taste in fishes, see ★Herrick, C. J. 1904.1, and ★Nagel, W. A. Add. 1894.1.

For additional references, see Herklotz, E. O. 1864.1; Parker, G. H. 1908.2, 1912.1; Plehn, M. 1905.3; Herrick, C. J. Add. 1902.2; Parker, G. H. & Stabler, E. M. Add. 1913.1.

Vibratile dorsal fin of Motella creates water currents into the dorsal fin groove, which is lined with taste buds and is a food detecting organ. Thomson, J. S. 1911.1, 1912.1.

TAXONOMY OF FISHES

For the taxonomy of particular groups of fishes, see under these groups in the Systematic section.

Number of species of fishes known (estimated). — Number in 1831. Günther, A. 1896.3. — 12,000 estimated in 1912. Henshaw, H. W. Add. 1912.1. — Number, American fossil species. Hay, O. P. 1899.1.

"Fish names, ancient and modern." Eastman, C. R. Add. 1917.2.

CLASSIFICATION

For manuals to be used in the classification of fishes from any geographic region, see under Fauna of the world.

For essays on the gradual development of our present system of classification, see Historical matter under Ichthyology.

Availability of embryological characters, germ layers, etc., in classification. Lankester, E. R. 1873.3, 1877.1; Ryder, J. A. 1885.7.

Taxonomic value of the brain. Burckhardt, C. R. 1897.3; Mayer, A. F. 1864.1; Wilder, B. G. Add. 1911.1. — Proposed system, based on conditions of cavities of central nervous system. Wilder, B. G. 1887.2.

Relation to classification, of the structure of the — reproductive system. Howes, G. B. 1891.2. — fin-rays. Ryder, J. A. 1887.5. — teeth. Linck, H. F. Add. 1789.1.

Larger and more important treatises on the systematic arrangement or relations of fishes; families, subfamilies, orders, etc. Brandt, J. F. 1865.1; Canestrini, G. 1859.3; Cope, E. D. 1871.8, 1889.5; Fitzinger, L. J. 1873.1; Gadow, H. 1898.1; Gill, T. N. 1893.2; Gregory, W. K. 1907.1; Müller, J. 1843.1,2, 1844.2; Pascoe, F. P. 1877.1; Regan, C. T. 1909.4, 1912.13.

Miscellaneous notes on classification: relations of the different classes of vertebrates, special characters and position of the class of fishes, etc. Agassiz, J. L. 1834.3, 1850.1, 1858.1,8; Agassiz, L. & Egerton, P. G. 1837.1; Bayer, F. 1900.1; Cope, E. D. 1868.2, 1871.8,9, 1872.2,4,16, 1877.4, 1885.2,3, 1888.2, 1889.5; Cuvier, G. L. 1814.1; Dana, J. D. 1863.1,3; Dean, B. 1895.4; Gill, T. N. 1861.7, 1873.3,7.

Taxonomy — Cont'd.

1898.1, 1912.1, Add. 1881.2; Gravenhorst, J. L. 1807.1; Hussakof, L. 1910.2; Huxley, T. H. 1876.1; Jordan, D. S. 1903.1, 1904.1; Kemna, A. 1903.1; Macleay, W. S. 1841.1; Putnam, F. W. 1872.6; Segond, L. A. 1873.1; Smitt, F. A. 1895.1; Vaillant, L. L. 1872.1.

NOMENCLATURE**Pre-Linn. nomenclature**

Before the publication by Linnæus of the 10th edition of the *Systema Naturæ* (1758), which is the starting point for modern binomial nomenclature, numerous writers had compiled lists of local or vernacular names with attempted appropriate designations in Latin or Greek. The following titles which partly represent such attempts will be found in the Pre-Linn. section. Albin, E. 1735.1; Barrère, P. 1741.1; Breton, R. 1665.1; Charleton, G. 1667.1; Eber, P. & Peucer, C. 1551.1; Estienne, C. 1536.1; Fabricius, G. 1569.1; Figulus, C. 1540.1; Gesner, C. 1556.1; Gilles, P. 1535.2; Mortimer, C. 1740.1; Peucer, C. 1550.1; Quercu, L. 1539.1; Salviani, H. 1554.1; Schonevelde, S. A. 1624.1.

Forerunners of Linnæus: earlier writers who recognized modern basis of classification but who used polynomial nomenclature. Artedi, P. 1738.1; Gronovius, L. T. 1754.1; Klein, J. T. 1740.1; La Chesnaye Desbois, F. 1754.1; Ray, J. 1710.1; Willughby, F. 1686.1.

Scientific nomenclature

Original editions of the "*Systema Naturæ*" of Linnæus; supplemental editions of others, and notes on various Linnæan names. Donndorf, J. A. 1798.1; Gmelin, J. F. 1788.1; Goode, G. B. & Bean, T. H. 1885.4; Hopkinson, J. 1908.1; Jordan, D. S. 1886.5, 1886.6, 1891.3; Linnæus, C. 1758.1–1776.1, Pre-Linn. 1735.1; Müller, P. L. Add. 1776.1. — *Index to genera in 10th and 12th editions*. Sherborn, C. D. 1899.1.

Various nomenclatural notes: on the admission or rejection of certain names, status of names of Oken, Osbeck, Shaw, Swainson, Walbaum, et al., etc. Fox, W. J. 1900.1; Gill, T. N. 1861.7, 1897.2, 1903.6, 7, 10; Hay, O. P. 1899.3, 4, 5; Jordan, D. S. 1916.1; Jordan & Gilbert 1883.21; Swain, J. 1882.1, 2.

Proper construction of scientific names of Latin and Greek derivation. Martens, E. 1896.1; ★Miller, W. 1897.1.

Genera of fishes. (The "*Zoological Record*" publishes an annual list of genera and subgenera published during the year covered.)

General compendia (Nomenclator zoologicus, etc.) of generic names proposed in all groups, including fishes from 1758 to 1879. Agassiz, J. L. 1842.1, 1846.1, 1848.4; Marschall, A. F. 1873.1; Scudder, S. H. 1881.1, 1882.1; Sherborn, C. D. 1902.1.

"*Index zoologicus*," a list of generic names proposed from 1880 to 1910. Water-

house, C. O. 1902.1–1912.1. — *Corrections and additions to this list*. Bergroth, E. E. 1904.1; Poche, F. 1907.1, 1908.1, 1909.1, 1912.1.

List of genera. Gray, J. E. 1838.2.

For the most recent contribution with the fixation of the types (1758 to 1920), see ★Jordan, D. S. Add. 1917.1.

VERNACULAR AND COMMON NAMES

Aramaic fish names. Löw, I. 1906.1. — *Indian names for New England fishes*. Williams, R. Pre-Linn. 1643.1.

Vernacular names of local fishes in use by native populations of — Chile. Delfin, F. T. 1901.2. — *Cape Colony*. Gilchrist, J. D. 1902.2. — *Java*. Kampen, P. N. 1909.2. — *Burma*. Mason, F. 1860.1. — *Samoa*. Krämer, A. Add. 1903.1. — *Pelau Is.* Kubary, J. S. Add. 1889.1. — *Japan*. Kuroda, C. Add. 1914.1. — *Brazil*. Martius, C. F. Add. 1867.1. — *New Zealand*. Taylor, R. Add. 1870.1.

Vernacular names of European fishes, including colloquial and local names.

Collections of the vernacular names of European fishes in general, with their equivalents in several languages. Belloc, E. 1899.1; Henking, H. 1899.1; ★Hoek, P. P. 1904.1; MacLagan, N. 1884.1; Martens, E. 1910.1.

Common names in use in British Isles. Cunningham, J. T. 1889.5; Koehler, J. J. 1906.1; MacLagen, N. 1884.1; Satchell, T. 1879.1.

Vernacular names of French fishes. Barbier, P. 1908.1; Belloc, E. 1899.1; Brünnich, M. T. 1768.1; Daguin, — 1904.1; Theuratte, A. D. 1898.1.

Local names of German fishes. Buxbaum, L. 1893.1; Hofer, A. 1880.1; Leonhardt, E. E. 1904.18.

Greek names, ancient, middle, and modern. Bickélas, D. 1878.1; Gill, T. N. 1905.1; Krumbacher, K. 1903.1.

Italian, Maltese and Sicilian names of native fishes, including equivalents in other languages. Barbaro, G. C. 1869.1; Faber, G. L. 1883.1; Franco, G. 1911.1; Martens, E. 1857.1; Police, G. 1912.2; Tomasini, C. 1906.1; Trapani, G. 1838.1; Smyth, W. H. Add. 1824.1; Swinburne, H. Add. 1783.1.

Portuguese vernacular names of local fishes. Furtado, F. 1886.1. — *Of fishes of Madeira Is.* Lowe, R. T. 1841.1, 1843.1.

Vernacular names in use in — Netherlands. Bemmelen, A. A. 1866.1; Hoek, P. P. 1912.2. — *Sweden*. Ekman, T. 1902.1; Lönnberg, A. J. 1894.4, 1903.2, 1906.2. — *Carniola, Austria*. Freyer, H. 1842.1. — *Iceland*. Olaffen, O. Add. 1780.1.

TECHNIQUE AND METHODS

Their use in scientific investigation.

For a related topic, see Collection, Preservation, and Exhibition of fishes.

Apparatus for research. Including methods of use. *Physometer*, for determina-

tion of air volume changes in air bladder. Harting, P. 1872.2, 1874.2.

Apparatus for holding fishes for vivisection: technique, etc. Pettit, A. 1904.1; Polimanti, O. 1913.3; Schoenlein, K. 1895.1.

Dynamometer for mensuration of muscular pull. Regnard, P. 1893.2, 5.

Apparatus for study of respiration. Dissard, A. 1894.1; François-Franck, C. A. 1906.1, 2; Flourens, M. J. 1862.1; Jolyet, F. & Regnard, P. 1876.1; Roques, L. 1906.1, 2; Zuntz, N. 1901.1; Hemmeter, J. C. Add. 1911.1.

Electro-cardiography in the study of heart action. Bakker, N. C. 1912.1, 2; Laulanié, — 1889.1; Eiger, M. Add. 1913.1; Hemmeter, J. C. Add. 1911.1.

Special apparatus used in the study of the electrical discharge of electrical fishes. DuBois-Reymond, E. H. 1881.1; Garten, S. 1910.1, 2; Gotch, F. 1888.1; Sachs, C. 1881.1; Biedermann, W. Add. 1895.1.

Mensuration of size; apparatus and methods. Iches, L. 1908.1; Riddell, W. 1914.1; Samter, M. 1907.1. — Somatic coefficient, plan for expression of measurements. Camerano, L. 1900.1, 1901.1. — Instrument for measuring fossil fish. Young, J. 1868.1.

Methods of study and technique.

Skeletons, technique of preparation. Bluett, — 1830.1; Johnson, J. S. 1877.1. — Cartilaginous skeletons. Braun, M. G. 1894.1; Parker, T. J. 1882.2.

Ova and embryos, preparation. Collinge, W. E. 1892.1; Henneguy, L. F. 1879.1; Smith, B. G. 1914.1.

Habits and life histories, methods of study. Holder, C. F. 1908.2; Reighard, J. E. 1910.1.

Artificial circulation applied to detached heads of fishes. Kuliabko, A. 1907.1, 2, Add. 1907.1. — Trough for exhibiting circulation in the caudal fin. Milner, W. R. 1859.1.

Various methods. — For dissection and study of nervous system. Baudelot, E. 1878.1; Rawitz, B. 1909.1. — For demonstration of neurofibrils. Bielschowsky, — 1908.1; Fusari, R. 1901.1.

Demonstration of casts of brain. Edinger, L. 1907.1.

Physiological salt-solution for marine animals. Muskens, L. J. 1894.1.

Injection of kidney for study. Hyrtl, C. J. 1863.3. — Injection method for comparative anatomy. Rand, H. W. 1905.1. — Intra-vitam staining. Retzius, M. G. 1898.1.

Freezing point methods in study of blood. Greene, C. W. 1905.1. — Serial sections in study of fossils. Sollas, W. J. 1901.1, 1904.1.

Narcotization of sharks. Sulima, A. 1909.1.

Zoological dictionary, explanations of zoological terms. Ziegler, H. E. 1909.1.

Röntgen rays and radiographs, application and value. Abel, C. 1908.1; Townsend, C. H. 1906.4.

Photography. Living fishes, chiefly in aquaria and in their natural environment. Bade, E. 1899.8, 1901.3; Brühl, L. 1900.1; Holder, C. F. 1899.3; Köhler, W. 1904.1; Letkemann, H. V. 1902.1; Mülleger, S. 1912.1; ★Reighard, J. E. 1908.2; ★Shufeldt, R. W. 1897.1–1911.1; Ward, F. 1911.1; ★Bryan, W. A. Add. 1911.1; Dugmore, A. R. Add. 1902.1.

Photochronograph, for making photographs at timed intervals. Use — in study of locomotion. Anthony, R. & Chevroton, L. 1913.1; Marey, E. J. 1890.1. — in study of respiration. François-Franck, C. A. 1906.2, Add. 1907.1, 1914.1.

Photography with ultra-violet light. Franz, V. 1910.6. — Photography of developmental series. Kupffer, C. W. 1876.2; Reighard, J. E. 1900.3.

TEMPERATURE (EFFECTS ON FISHES)

Reactions of fishes to variations in temperature. Dupony, — 1894.1; Knauthe, K. 1891.4; Loeb, J. & Wasteneys, H. 1912.1; Michael, E. Add. 1907.1; Wells, M. M. Add. 1914.1.

Effects of temperature on development of ova. Dannevig, H. C. 1894.1; Dannevig, H. C. & Fulton, T. 1895.1; Drouin de Bouville, R. 1908.2; Grimm, O. 1904.2; Hein, W. 1911.2; Meyer, H. A. 1879.2; Reibisch, J. 1902.1; Williamson, H. C. 1910.1, 3, 1911.1. — Influence on embryonic circulation. Millet, C. 1864.1.

Effects of temperature upon iris. Brown-Séquard, C. E. 1859.1; Müller, H. 1861.1. — On vitality of fishes. Davy, J. 1862.1. — On pigmentation. Frisch, K. 1911.3. — Relations to number of vertebrae. Jordan, D. S. 1892.2, 1893.2, 1894.3. — Relation to the number of fin-rays in *Pleuronectidæ* (reduction in warmer climates). Cox, P. Add. 1903.1.

Cold, effects. Dönhoff, —. 1872.1; Heath, N. 1883.1; Marès, H. 1850.1, Add. 1850.1; Marion, A. F. 1894.2; Vidal, J. L. 1870.1, 1871.1; Beal, J. Pre-Linn. 1666.1.

Influence on pigmentation and respiration, Apogon. Polimanti, O. 1912.2.

Cold causing mortality. Bouney, T. G. 1891.1; Jennings, F. M. 1841.1. — Destruction on Florida coast. Packard, A. S. 1870.1; Wilcox, J. 1887.1. — At Bermuda, 1901. Verrill, A. E. 1901.1. — Eels. Thompson, W. 1841.3.

Extremes of temperature in which fishes can live. Maurel, — & Lagriffe, — 1899.1, 2, Add. 1899.1; Carter, A. W. Add. 1887.1.

Basic or lowest temperature. Dutrochet, R. J. 1840.1, 2; Pictet, R. 1893.1; Regnard, P. 1895.1.

Maximum or highest temperature. Bert, P. 1867.4; Davy, J. 1862.1; Davenport, C. & Castle, W. 1895.1; Frenzel, J. 1885.1; Knauthe, K. 1895.3; Lefebvre, A. 1872.1; Vernon, H. M. 1899.1, 1900.1.

Temp. Effects — Cont'd.

Heat, influences. Day, F. 1885.2; Fatio, V. 1899.2; Frenzel, J. 1896.1; Goette, A. 1909.1. — *Influence on pigmentation.* Murisier, P. 1912.1.

Shad killed by heat in Connecticut R. Green, S. 1869.1. — *Volcanic heating of water effecting migrations.* Krebs, W. 1912.1.

Resuscitation of frozen fishes after animation had been suspended.

Reports of occurrences, experiments, etc. Aitch, W. 1875.1; Clarke, R. 1854.1; Dougherty, W. E. 1875.1; Hubbard, O. P. 1850.1; Kirtland, J. P. 1851.1; Knauthe, K. 1887.1; Lathrop, S. P. 1852.1; Mowry, A. H. 1875.1; Peirce, M. P. 1884.1; ★Pictet, R. 1893.1; Smiley, C. W. 1884.12; Welsher, H. W. 1879.1; Wigg, G. 1882.1; Zur Mühlen, M. 1911.14; Anon. 632; Athenæus, N. Pre-Linn. 1680.1.

Resuscitation after hibernation, Umbra. Abbott, C. C. 1874.3; *Dallia.* Turner, L. M. 1886.1 (p. 101).

Relations between climate and fisheries. (*Meteorological conditions.*) *Miscellaneous.* Eidsvaag, E. 1909.1; Marion, A. F. 1894.7; Muirhead, G. 1903.1.

Climatic influences on fisheries of — Sardine. Blavier, A. 1882.1; Odin, A. 1896.1. — *Herring.* Buckland, F. T., Walpole, S. & Young, A. 1878.1; Krebs, W. 1911.1; Otterstrøm, A. N. 1910.1. — *Anchovy.* Fowler, G. H. 1889.1.

Effects of Gulf stream on European sea fisheries. Johnstone, J. 1910.3.

TEMPERATURE OF FISHES (OR CALOR ANIMALIS)

In fishes, as in other "cold-blooded animals," the body temperature is generally considered to be variable and approximately that of the surrounding medium.

Davy observed a deep-muscle temperature in the bonito (*Thynnus*) nearly 10° C. higher than the water.

Subsequently, Kidder demonstrated by special thermometers that readings as usually taken in the œsophagus or rectum are untrustworthy and that those from deeper centers such as heart, liver or stomach show an excess of several (4 or 5) degrees F. above the water temperature.

More recently Simpson has found that small examples show practically no excess while larger examples show a temperature averaging a half degree Centigrade higher than the water.

Observations, actual records of temperature, and methods of investigation. ★Kidder, J. H. 1880.1; King, R. 1836.1; Portier, P. 1903.1, 1908.1; Regnard, P. 1895.3; ★Simpson, S. 1908.1, 2. — *Thynnus considered a warm-blooded fish.* Davy, J. 1835.1, Add. 1835.2.

Miscellaneous notes, reviews, etc. De-laroche, F. E. 1807.1; Fibich, S. 1904.1; Gill, T. N. 1881.3; Grieg, J. A. 1909.1; Harting, P. 1880.1; Kidder, J. A. 1880.1; Anon. 106, 586. — *Production of heat.* Dubois, R. 1899.3.

TERATOLOGY

See also under related subjects such as *Hermaphroditism, and Regeneration.* For *Ambicoloration or unicoloration in flat-fishes, see under Pleuronectidæ.* For all other *Abnormalities in coloration, see under Coloration.*

General treatises. For a model treatise with discussions of causation, development, etc., and with a résumé of the literature, see ★Gemmill, J. F. 1912.1.

Other general treatises. Heusner, — 1824.1; ★Otto, A. W. 1841.1; Rauber, A. 1877.1, 1879.1; ★Schwalbe, E. 1906.1; Taruffi, C. 1894.1; Geoffroy-Saint-Hilaire, I. Add. 1832.1; Rayer, P. F. Add. 1843.1. — *Earliest general work.* Aldrovandi, U. Pre-Linn. 1642.1.

Experimental results. *Artificial production of monsters by use of saline and sugar solutions and other media.* Bataillon, E. 1901.1, 2; Lereboullet, D. A. 1861.2, 1862.1, 3; Supino, F. 1896.1; Tornier, G. 1908.1, 1911.1; Dareste, C. Add. 1861.1; Loeb, J. Add. 1915.1. — *urea, butyric acid, sodium glycocholate, etc.* Werber, E. I. 1915.1, 2. — See also ★E. I. Werber in *Journ. Exper. Zool.*, 1916, vol. 21, pp. 485–573; and 1917, vol. 24, pp. 409–436.

See also below under *Cyclopia*, for experimental production of this abnormality.

Miscellaneous papers. Barras de Aragón, F. 1905.1; Couch, J. 1868.1; Keith, A. 1909.1; Marchand, E. 1901.1; Nusbaum, J. 1907.3; Rabaud, E. 1901.1, 2; Richard, J. 1912.1; Traquair, R. H. 1900.3; Williamson, H. C. 1911.2. — *Collection in Royal College of Surgeons, London; catalogue.* Lowne, B. T. 1893.1. — *Dwarf races of fishes.* Klunzinger, C. B. 1900.1.

Various abnormalities. *Abnormal dentition in — Raja.* Day, F. 1880.2. — *Rhinoptera.* Woodward, A. S. Add. 1888.1. — *Teeth replaced by gills in Acanthias.* Grosser, O. & Przibam, H. 1906.1. *Skin and Scales.* — *Hypertrophy of skin.* Arnold, J. P. 1911.16. — *Egg-cells in skin, Macropodus.* Zschiesche, A. 1910.1. — *Abnormal scales in pilchard.* Bateson, W. 1894.3. — *in flounders.* Herdman, W. A., Scott, A. & Johnstone, J. 1905.1. *Supernumerary barbels in Siluridæ.* Eigenmann, C. H. & Cox, U. O. 1900.1; Roth, W. 1905.2.

Abnormalities of gill-clefts in — Squalus. Ekman, G. 1910.1. — *Myxine and Petro-myzon.* Howes, G. B. 1893.1. — *Petro-myzon lacking branchial orifices.* Blanc, H. 1913.1. — *Opercular gills, abnormal in Polypterus.* Boulenger, G. A. 1899.8. — *Operculum perck.* Flintoff, R. J. 1896.1. *Two ova in one egg case in sharks.* Joseph, H. 1906.1; Vayssière, A. 1909.1.

Abnormalities with type of anomaly not indicated. — *Anguilla.* Ninni, E. 1910.1. — *Barbus.* S., G. 1880.1. — *Carassius.* Charvet, P. A. 1826.1. — *Carp.* Böckh, G. 1863.1; Tiedemann, D. F. 1819.1; Ballot, — Add. 1837.1. — *Salmonidæ.*

Fabani, C. 1897.1; Grieg, J. A. 1911.2; Anon. 570.

ABNORMALITIES OF THE EYE

Various sorts of anomalies. Girdwoyń, M. 1880.1; Makarius, S. 1898.1. — *Abnormal eye-muscle in Carcharias*. Allis, E. P. 1899.1. — *Eyeless spm. of Cyprinus*. Baer, K. E. 1862.1. — *Doubling of crystalline lens*. Hilgendorf, F. M. 1903.1. — *Develop. of lens without other eye-parts*. Mencl., E. 1903.1. — *Supernumerary eyes*. Gemmill, J. F. 1906.1. — *Three-eyed dab*. Meek, A. 1910.1. — *Three-eyed Whiting*. Rose, C. W. 1863.1. — *One-eyed cod*. Sandeman, G. 1893.1. — *One-eyed trout*. Yung, E. J. 1901.1. — *Atrophy in Raja*. Smallwood, W. M. 1908.1.

For anomalies of the eye in flat-fishes, such as arrested migration during metamorphosis, etc., see under *Pleuronectidæ*.

Cyclopia. A single, median-eyed condition. Occurrence. — in *Teleostei*. Gemmill, J. F. 1900.1, 1906.2; Chidester, F. E. Add. 1914.1. — in *Myliobates noctula*. Paolucci, L. 1874.1.

Artificial or experimental production of cyclopia by various solutions. Lereboullet, A. 1861.2; Lewis, W. H. 1909.1; McClendon, J. F. 1910.1, 1912.1; Spemann, H. 1904.1; ★Stockard, C. R. 1907.1, 1908.2, 1909.1, 2, 1910.1; Tornier, G. 1908.1, 1911.1.

ABNORMALITIES OF FINS

Gen. acct., fin anomalies. Freund, L. 1907.1.

Carp with all fins greatly elongated. Bean, B. A. 1909.2.

Misc. papers. — *Origin*. Buschkiel, A. 1907.1. — *Paired anal and caudal fins*. Cori, C. J. 1896.1. — *Anomalies in Pleuronectidæ*. Duncker, G. 1900.2. — *Supplementary fin in Tinca*. Yung, E. Add. 1914.1.

Anal fin. Anomalies in — *Sebastes*. Jaquet, M. 1906.1. — *Plaice*. Johnstone, J. 1904.2. — *Proteracanthus*. Pellegrin, J. 1899.3. — *Goldfishes*. Watase, S. 1887.1, 1894.1.

Caudal fin. — *Larval Petromyzon with three caudal fins*. Barfurth, D. 1899.1. — *Caudal absent in carp*. Fiebiger, J. 1907.1; Nusbaum, J. 1907.3; Tarnanil, I. K. 1911.1. — *Caudal and peduncle lacking, Esox*. Hofer, B. 1901.3. — *Anomalies in Silurus and Motella*. Jaquet, M. 1899.1, 1907.2. — *Precaudal fin frill in plaice*. McIntosh, W. C. 1908.2. — *Syngnathus with duplicated tail*. Malm, A. W. 1862.1. — *Pleuronectes with secondary caudal*. Woodward, H. 1908.1.

So-called "tailless trout" of *Lochna-moarachan*, Islay, Scotland, *Salmo islayensis* or *S. fario*. Peach, C. W. 1871.1; Thomson, J. 1873.1; Traquair, R. H. 1872.1, 1882.2, 1892.5.

Dorsal fin. Accessory fins in — *Acanthias*. Grosser, O. & Przibram, H. 1906.1. — *Salmo*. Seligmann, C. G. 1898.1.

Pectoral fin. Abnormality, resembling digital structure, in *Protopterus*. Albrecht, P. 1886.3; Blanchard, R. 1894.1; Boulenger, G. A. 1891.4; Hopley, C. C. 1891.1. — *Duplicity in Lepidosiren*. Brindley, H. H. 1900.1; Goeldi, E. A. 1898.1.

Abnormalities corresponding to types of limb structure. Ercolani, G. B. 1881.1.

Type of abnormality in rays in which the pectorals are not adherent to the head. ★Anisits, J. D. 1912.2; Bureau, L. 1890.1; Day, F. 1880.2; Filippi, F. 1852.1; Fleming, J. 1841.1; Gervais, F. L. 1864.1; Hill, J. P. 1895.1; Johnstone, J. 1906.2; Paolucci, L. 1874.1; Pellegrin, J. 1900.8; Rafinesque, C. S. 1810.2; Reinhardt, J. C. 1825.1; Richardson, J. 1859.1; Traquair, R. H. 1892.4; Vaillant, L. L. 1908.2; Williamson, H. C. 1911.2. — *Described as Propterygia, n. g.* Otto, A. W. 1821.2, 1822.1. — *Propterygia shown to be teratological*. ★Lütken, C. F. 1880.2; Gill, T. N. 1896.13. — *First known acct. and fig.* Gesner, C. Pre-Linn. 1556.1.

Pectorals absent in — *flounder*. Gill, T. N. 1881.3. — *Silurus*. Jaquet, M. 1897.3.

Supernumerary pectorals in — *Salmo irideus*. Mazzarelli, G. F. 1905.2. — *Raja*. Deslongchamps, J. A. 1853.1; Rennie, J. 1906.1. — *Presence in Symbranchus, normally absent*. Derjugin, K. M. 1912.1.

Ventral or pelvic fins. Anomalies in — *Leuciscus dobula*. Martens, E. 1859.1. — *Pagellus*. Mazza, F. 1890.1. — *Elongation in Tinca*. Billard, G. 1912.1. — *Male dogfish, with abnormal external genital apparatus*. Mudge, G. P. 1899.1.

Supernumerary pelvics (*Pygomely*). Anthony, R. & Salmon, J. 1901.1. — in *Phoxinus*. Derjugin, K. M. 1912.1. — in *Glanis*. Varpakhovskii, N. A. 1888.2.

Ventrals absent in — *Abramis*. Brindley, H. H. 1891.1. — *Ameiurus*. Eigenmann, C. H. & Cox, U. O. 1900.1.

VISCERAL ABNORMALITIES

Abdominal abnormalities. — *Misplacement of abdominal cavity*. Raffaele, F. 1889.2. — *Gastrodidymus, double-formation of belly*. Rauber, A. 1879.2.

Circulatory system. — *Deformations*. Künstler, J. & Gruvel, A. 1899.1. — *Embryos without circulation*. Loeb, J. 1893.1.

Digestive system. — *Perch without pyloric caeca*. Forbes, S. A. 1885.1. — *Dogfish with everted stomach*. Mudge, G. P. 1905.1, 1906.1. — *Abnormal spiral valve, Raja*. Parker, T. J. 1885.1. — *Branched caeca, Centrolophus*. Riggio, G. 1894.2. — *Prolapsus recti*. Pégot, G. 1900.1. — *Sparus with a supplementary anus*. Williamson, H. C. 1911.4. — *Abnormal intestine, carp*. Freund, L. Add. 1914.1.

Reproductive organs. — *Three lobed ovary, Acipenser*. Grimm, O. 1906.2. — *Arrested development in gonad of Conger*. Hefford, A. E. 1907.1. — *Hypertrophied ovaries in Cobitis*. Lunel, G. 1880.1. — *Oviduct, male skate*. Matthews, J. D.

Teratology — Cont'd.

1885.1. — *Abnormalities in Scyllium*. Borcáa, J. 1904.8.

Nervous system. — *Defective brain, Torpedo*. Coggi, A. 1891.1. — *Auditory nerve, anomaly*. Cortese, F. 1868.1. — *Suppl. lateral line, Acipenser*. Jaquet, M. 1899.2. — *Abnormal cerebellum, Alopias*. Léger, M. 1887.1. — *Pelvic plexus, Acanthias*. Punnett, R. C. 1901.1.

AXIAL ABNORMALITIES

Skull abnormalities, type not indicated. — *Labrax*. Ayres, W. O. 1849.4. — *General*. Freund, L. 1907.1. — *Esox*. Poppius, B. 1911.1. — *Gadus*. Wyman, J. 1851.2.

Abnormalities in snout and jaws. *Malformed jaws in — Esox*. Brofeldt, P. 1912.1; Hopewell-Smith, A. 1908.1. — *Trigla*. Johnston, J. 1906.2. — *Produced jaws in Salmo*. Yung, E. J. 1901.1.

Anomalies of the snout in — Acipenser and Sargus. Jaquet, M. 1897.1, 1911.1. — *Carp*. Erhard, G. Pre-Linn. 1748.1; Hamberger, G. E. Pre-Linn. 1748.1.

Buccal occlusion or absence of mouth. *Associated with abnormalities of jaws, etc.*

Examples in the carp. Fehlmann, J. W. 1912.1; Hofer, B. 1904.2,3; Schiemenz, P. 1897.1; Steindachner, F. 1863.7; Wundsch, H. H. 1913.1; Geoffroy-Saint-Hilaire, I. Add. 1832.1.

Examples in — Abramis. Garstang, W. 1897.2; Münch, — 1911.1. — *Sclerognathus*. Lawrence, G. W. 1875.1. — *Chondrostoma*. Pellegrin, J. 1908.14. — *Catostomus*. Leidy, J. Add. 1875.1.

Shortening and curvature of snout; "Mopskopf." *Also called Pug-head or Bulldog-head, Tête du chien, etc.*

Examples in various fishes. Lönnberg, A. J. 1892.2; Ninni, E. 1903.2; Putnam, F. W. 1866.3; Stach, J. 1906.1. — *Heredity of "Mopskopfigkeit"*. Knauth, K. 1893.3. — *Artificially induced*. Tornier, G. 1908.1, 1911.1.

Examples in the carp (Cyprinus carpio). Böckh, G. 1863.1; Donnadieu, A. L. 1870.1; Heuscher, J. 1911.1; Jaquet, M. 1902.1; Steindachner, F. 1863.7; Aldrovandi, U. Pre-Linn. 1642.1.

In cod (Gadus morrhua). Cobbold, T. S. 1858.1; Federley, H. 1908.1; Patterson, A. H. 1898.1; Willumsen, P. J. 1901.1.

In salmon and trout. Buckland, F. T. 1877.2; Carlet, G. 1879.2; Krauss, F. 1886.1; Lidth de Jeude, T. W. 1885.1; Cornay, J. E. Add. 1847.1.

Examples in various teleosts. — *Mugil*. Canestrini, R. 1886.1. — *Labrax*. Fasciolo, A. 1904.1. — *Esox*. Hofer, B. 1901.3. — *Abramis*. Leonhardt, E. 1906.13. — *Cottus*. Nyström, E. 1889.1. — *Lumpenus*. Pappenheim, P. 1907.3. — *Trigla*. Patterson, A. H. 1897.1. — *Perca*. Pellegrin, J. 1908.16,17. — *Atherina*. Seabra, A. F. 1907.1. — *Roccus*. Sutton, A. C. 1913.1. — *Micropterus*. Herrick, F. H. Add. 1885.1.

Vertebral column. General anomalies. Deslongchamps, J. 1861.1; Hyrtl, C. J. 1849.4, 1862.1; Pellegrin, J. 1902.4; Wieber, J. D. 1903.1; Bruch, C. Add. 1862.2. — *Palistrophy (Coalesced vertebrae) in Cobitis*. Giard, A. 1900.3.

Vertebral and notochordal reduplications. Gemmill, J. F. 1906.1. — *Ling with five backbones*. Cornish, T. Add. 1884.1.

Spinal curvature. Misc. and gen. Holt, E. W. 1890.1; Howes, G. B. 1894.1; Keller, O. 1911.1; Koch, M. 1912.2; Williamson, H. C. 1910.1. — *In Chondrostoma*. Surbeck, G. 1913.3. — *Examples in Gadidae*. Smith, John A. 1867.10; Storrow, B. 1910.1; Williamson, H. C. 1911.3. — *in Salmonidae*. Cobbold, T. S. 1855.1; Ritchie, J. 1908.2; Surbeck, G. 1913.4; Vávra, V. 1906.1. — *Trigla*. Kyle, H. M. 1900.4.

DOUBLE MONSTROSITIES

So-called double or twin embryos occurring usually among the fry, recorded especially among salmon and trout. Including also "duplicities" in sense of Werber.

General treatises. *Anatomy, development, theories of causation, etc.* Blanc, L. 1896.1; ★Gemmill, J. F. 1901.1, 1903.1, 1912.1; Klaussner, F. 1890.1; Kopsch, F. 1899.1; ★Lanzi, L. 1911.1; ★Meckel, J. F. 1815.1; Panum, P. L. 1878.1; ★Schmitt, F. 1901.1, 1902.1; Valentin, G. G. 1851.1.

For a recent experimental analysis, with causation viewed as a developmental arrest, see ★Stockard, C. R. in Am. Journ. of Anat., 1921, vol. 28, 115-266.

Minor papers, records of occurrence, etc. *Chiefly Salmonidae*. Barbieri, C. 1906.2,3; Bataillon, E. 1900.3; Bean, B. A. 1889.3; Bugnion, E. 1880.1; Coolidge, A. 1869.1; Coste, P. 1855.1; Deslongchamps, J. A. 1862.1; Garman, S. & Denton, S. F. 1886.1; Geoffroy-Saint-Hilaire, I. 1855.1; Girdwoyn, M. 1880.1; Grieg, J. A. 1900.2; Jacobi, S. L. 1765.1; Knoch, J. 1873.1; Kaestner, S. 1898.1; ★Moser, F. 1907.1; Oellacher, J. 1874.1, 2; Quatrefages, J. L. 1855.1,2, 1874.1, 1888.1; Rauber, A. 1880.1; Salm-Horstmar, W. F. 1861.1; Serres, P. M. 1855.2; Windle, B. C. 1889.1, 1895.1; Chidester, F. E. Add. 1914.1; Putnam, F. W. Add. 1870.1.

Adult double monsters. — in Felichthys. Churchill, H. 1834.1. — *in Salmo*. Secques, F. 1895.1. — *Two-headed adult salmon*. Yarrell, W. 1836.1.

Double embryos of sharks, chiefly double-headed examples. Baster, J. 1762.2; Bean, B. A. 1889.3; Dohrn, A. 1902.1; Gadeau de Kerville, H. 1892.1; Levison, F. 1878.1; Willard, W. A. 1915.1. — *First known reference to double sharks*. Aldrovandi, U. Pre-Linn. 1642.1.

Double monstrosities in — Petromyzon. Bataillon, E. 1900.2. — *Girardinus*. Emeljanenko, P. E. 1907.4. — *Esox*. ★Lereboullet, A. 1855.1. — *Perca*. Baer,

K. E. Add. 1845.1. — *Zoarces*. Rathke, M. Add. 1833.1.

THEOLOGY AND FISHES

For the fish in mythology and folk-lore see *Mythology and Symbolism*.

For a valuable recent work in English, with chapters including discussions of the Christian fish symbol, the Tobias fish, and "Jonah and the whale," see Wm. Radcliffe, "Fishing from the earliest times." London. 1921. 478 p. ill.

The fish in Brahmanism and Buddhism. Carus, P. 1911.2. — *Zoology of the Talmud*. Lewysohn, L. 1858.1. — *Sacred fish in India*. Crooke, W. Add. 1906.1.

Christian fish symbol. "A fish frequently figures on the tombs of the early Christians in the catacombs at Rome: sometimes it bears on its back a bowl with wine and wafers of bread. Many tombs contain small fish of wood or ivory. Such fish served, we are told, as emblems and acrostics, pointing out to his co-religionists the burial place of a Christian without betraying the fact to the persecutors." Radcliffe.

For the latest and best monograph on the Christian fish symbol, see F. J. Dölger "Das Fischsymbol in frühchristlicher Zeit," Freiburg, 1910. A summary of this appears in the *Archiv für Religionswissenschaft*, 1912, vol. 15, p. 297.

Theories of origin of Christian fish symbol. Achelis, H. 1888.1; Garbe, R. 1914.1; Morey, C. R. 1910.1; Pischel, R. 1905.1; Polidori, L. 1841.1; ★Scheftelowitz, I. I. 1911.1.

The fish in religious festivals. — "Paul und Peter, in Mecklenburg. Fischerfest am 29 Juni." Karrig, Add. 1912.1. — *Christfische*. "Alte Sitte in Nürnberg." Anon. 660.

Tobias fish. Sand-launce (*Ammodytes*) of the Tigris, of which Tobias burned the heart and liver to drive away the demon Asmodeus. Bening, — Add. 1780.1. — Pre-Linn. refs. Bochart, S. 1619.1; Hardt, H. 1719.1; Seelen, E. G. 1708.1.

Fishes of the Bible

Accounts of the various fishes mentioned in the Holy Scriptures. Loreta, G. 1901.1; Thunberg, C. P. 1827.1; Tristram, H. B. 1867.2; ★Wood, J. G. 1868.1, 1869.1, Add. 1876.1; Harris, T. M. Add. 1824.1; Hart, H. C. Add. 1888.1.

Pre-Linn. refs. to *Biblical fishes*. Bochart, S. 1619.1; C., A. 1756.1; Clodius, D. 1675.1; Franz, W. 1643.1; Frey, H. H. 1594.1; Gardiner, S. 1606.1; Richter, J. G. 1754.1; ★Scheuchzer, J. J. 1731.1.

Locusts of the plague considered to be flying fish. Brodd, A. 1705.1.

Fishes of the Deluge: early belief that fishes in the rocks (i. e. fossils) were remains of the flood. Pre-Linn. refs. Scheuchzer, J. J. 1731.1; Torrubia, P. F. 1754.1; Vallisnieri, A. 1721.1.

Creation of Fishes. (*Fifth day of Creation*.) — Refs. in Pre-Linn. section.

Albertinus, A. 1613.1; Ambrose, 1472.1; Basilius Magnus 1551.1; Du Bartas, G. 1608.1; Eustathius, — 1629.1; Isidore of Seville, 1472.1; Kozack, J. S. 1662.1; Moor, B. 1716.1; Pisides, G. 1614.1; Scheuchzer, J. J. 1731.1.

Jonah and the Whale. *Early views showing belief that this animal was in reality a shark*. Gunner, J. E. Add. 1768.1; Holm, I. W. Add. 1776.1. — Pre-Linn. refs. Arctander, S. 1698.1; Beermann, S. 1719.1; Bochart, S. 1619.1; Colbiörnson, F. 1744.1; Engelbrecht, J. 1702.1; Frey, H. 1594.1; Hardt, H. 1718.1; Kirchmaier, — 1705.1; Lipenius, M. M. 1678.1; Major, J. H. 1685.1; Paullini, C. F. 1677.1; Pechlin, J. N. 1697.1; Pfeiffer, S. A. 1692.1; Scheuchzer, J. J. 1731.1; Siegesbeck, J. G. 1725.1; Willisch, C. G. 1721.1.

For an excellent monograph on the Jonah myth, see Hans Schmidt, "Jona: Eine Untersuchung zur vergleichenden Religionsgeschichte." Göttingen, 1907. ill.

THYMUS GLANDS

Glands in the pharyngeal region arising from the epithelial entoderm of the second to sixth branchial clefts.

For related structures, see *Thyroid Gland* and *Post-branchial Body*.

Anatomy and morphology. General treatises. ★Hammar, J. A. 1910.1; Hansen, C. P. 1832.1.

Anatomical researches on the thymus in — Ganoids. Ankarsvärd, G. & Hammar, J. A. 1913.1. — *Ammocætes*. Castellaneta, V. 1913.1. — *Elasmobranchs*. ★Hammar, J. A. 1911.1. — *Fishes in general*. Kner, R. 1864.3. — *Teleosts*. Maurer, F. 1886.1; Stannius, F. H. 1850.1. — *Ameiurus*. Mackenzie, T. 1884.1.

Development, general accounts. ★Beard, J. 1895.1; Meuron, — 1886.1.

In Elasmobranchii. — *Raia*. Beard, J. 1902.5. — *Spinax*. Fritsche, E. 1909.1. — *Selachii*. 1910.1; Maximow, A. 1912.1. — *Element of spiracle in thymus of Selachii*. Antipa, G. 1892.1; Beard, J. 1900.2.

Development in various fishes. — *Lepidosiren*. Bryce, T. H. 1906.1. — *Teleosts*. Nusbaum, J. & Prymak, T. 1901.1; Prymak, T. 1901.1–1903.1. — *Petromyzon*. Schaffer, J. 1894.1. — *Acipenser*. Sokolov, A. J. 1912.1.

Histology of the thymus. ★Hammar, J. A. (*Teleosts*) 1908.1; Prymak, T. 1902.1; Schaffer, J. 1893.1.

Physiology, function of thymus. Basch, — 1906.1; Beard, J. 1895.1, 1900.1. — *Relation to blood development.* Schaffer, J. 1893.1.

THYROID GLAND

A ductless gland found in the pharyngeal region, arising as an unpaired pocket in the floor of the pharynx.

For related bodies, see *Thymus Gland* and *Post-branchial Body*.

For carcinoma of thyroid in brook-trout, see under *Pathology*.

Thyroid — Cont'd.

Anatomy and morphology. General treatises. — *Vertebrates especially Selachii.* ★Guiard, J. 1896.1. — *Vertebrates.* Thompson, F. D. 1910.1.

Miscellaneous papers. Herrmann, G. & Verdun, P. 1900.1; Julin, C. 1887.5. — *Structure, distribution, and variation.* Gudernatsch, J. F. Add. 1909.1.

Anatomy in Cyclostomata. — *Petromyzon.* Reese, A. M. 1902.1. — *Ammocætes.* Schrön, O. 1865.1. — *Myxine.* Schaffer, J. 1906.1.

In Elasmobranchii. ★Ferguson, J. S. 1911.1; Goodey, T. 1910.2; Lombard, G. D. 1909.1; Robin, C. P. 1847.3.

Ganoidei. Hyrtl, C. J. 1852.1.

Teleostei. ★Gudernatsch, J. F. 1911.2; Mackenzie, T. (*Ameiurus*) 1884.1; Maurer, F. 1886.1.

Development. General accounts. Meuron, — 1886.1; Müller, W. Add. 1871.1. — *Amphioxus, Cyclostomes, and Pisces.* ★Dohrn, F. A. 1882.2 (vii, xi, xii).

In Cyclostomata. — *Ammocætes.* Marine, D. 1913.1. — *Petromyzon.* Reese, A. M. 1902.1. — *Bdellostoma.* Stockard, C. R. 1906.3.

Histology. Ammocætes. Renaut, J. & Policard, A. 1905.1.

Physiological and chemical papers. — *Iodine content of thyroid.* Cameron, A. T. 1913.1. — *Relations between normal and pathological thyroids.* Gudernatsch, J. F. 1911.1. — *Effects of thyroid feeding in young salmon.* Giacomini, E. Add. 1914.2.

URINOGENITAL SYSTEM (OF FISHES)

Comprising the structure of the excretory, nephridial or renal organs, and the generative or reproductive organs of fishes. Since in fishes, as in the other groups of vertebrates, there exists an intimate developmental and topographical relationship between the excretory and reproductive organs, the ducts of the former serving to carry the products (eggs or sperms) of the latter, the two systems have in the literature generally been considered together and are so treated here.

Few morphological systems have been the subject of greater controversy than the present and, as far as possible, the present state of these controversies is indicated below.

The most valuable comprehensive general treatise (in German) on the development and structure of the urinogenital system in vertebrates, including all groups of fishes and containing an extensive bibliography, is the series cited under ★Felix, W. & Bühler, A. 1906.1, 2.

Similar comprehensive general treatises in German are those of ★Rückert, J. Add. 1892.1; *brought up to 1904 by* ★Felix, W. Add. 1904.1.

The most recent and valuable summary in English is the account in the "Text-book of Embryology" by ★Prof. J. G. Kerr. Vol. II, (*Vertebrata*), London, 1919, 591 p.

Other readable general summaries in English may be found in Bridge, T. W. 1904.1, *and in* Kingsley, J. S. 1912.1.

Miscellanea

Older but still interesting and historically valuable accounts of the excretory organs, in English, are cited under Balfour, F. M. 1876.2, 1882.1; *and* Sedgwick, A. 1881.1.

Various general works in German, treating of the excretory or urinogenital organs in nearly all groups of fishes are Fürbringer, M. 1878.2; ★Hoffmann, C. K. 1886.1; Hyrtl, C. J. 1850.1; Solger, B. F. 1882.1.

Similar older general works in French on the reproductive organs are Martin-Saint-Ange, G. J. 1856.1; Treviranus, G. R. 1826.1, 2; Vogt, C. C. & Pappenheim, S. 1859.1.

Various unclassified, relatively unimportant, or older papers on the excretory organs. Cappello, O. 1845.1; Crevatin, F. 1904.1; Huefner, C. G. 1866.1; Müller, J. 1845.3; Rathke, M. H. 1837.2; Burnett, W. I. Add. 1854.2.

External urinogenital appendages

In both males and females of the Siluroid Plotosus, behind the urinogenital papilla, there is a peculiar arborescent vascular and glandular appendage of unknown function. Brock, J. 1888.1; Hirota, S. 1895.1.

In both sexes of the Syngnathid, Gasterotokeus, (better developed in females) there is a protuberance covered with papillæ (tastkissen) just before the anal fin. Brock, J. 1887.1.

In both sexes in various species of Blennius, peculiar complicated urinogenital appendages occur. ★Guitel, F. 1893.1.

The structures just mentioned are presumably not to be confounded with the male intromittent organs of certain viviparous fishes.

For the copulatory organs (Myxopterygia) of male Elasmobranchs, see below Viviparity under Reproduction.

For the intromittent organs of various viviparous Teleosts, see under such families as Pæciliidæ below Ovarian gestation of Teleosts likewise under Viviparity.

EXCRETORY ORGANS

The whole series of vertebrate nephridial tubes was termed "archinephros" by Lankester (1877.1). Sedgwick (1881.1, p. 458) held the view that the pronephros, mesonephros and metanephros (Lankester's terms) are merely successive parts of a single, elongated ancestral excretory organ which possessed a duct and segmentally arranged nephridial tubules.

These views were further substantiated by Price's work on *Bdellostoma* (Price, G. C. 1897.1) who conceived of the entire embryonic kidney as a "holonephros" from which the pronephros and mesonephros are derived.

These views of homologies are now generally accepted.

A related view is that of Audigé (1910.1, p. 614) who conceives of the Teleostean kidney as a "mononephros" in which the three regions, when they exist, are synchronous in development.

Pronephros

Called also "Vorniere" and "head-kidney." As considered by Balfour (1882.1) the pronephros is a purely larval organ ordinarily

functioning only in larval vertebrates. For possible exceptions to this statement among Teleosts, see below under "Persistence of pronephros."

As pointed out by Sedgwick (1881.1) the pronephros is greatly reduced or non-functional in meroblastic vertebrates.

Origin of pronephric duct. Various conclusions have been held concerning the origin of the pronephric (called also archinephric and segmental) duct. In Elasmobranchs, this was described by van Wijhe, Beard, Rückert, and Gregory, as arising by the splitting off of a longitudinal ridge-like projection from the ectoderm. More recently Rabl and Bates have maintained that the anlage of the duct is a direct outgrowth of the pronephros and therefore mesodermal in origin.

Discussions of the origin of the pronephric duct in Elasmobranchs. ★Bates, G. A. 1914.1; Beard, J. 1888.5; Gregory, E. R. 1897.1; Haddon, A. C. 1886.1; ★Rabl, C. 1896.1; ★Rückert, J. 1888.2, 1889.2; Wijhe, J. W. 1886.1, 1888.1, 2, 1898.1.

Similar conflicting views have been held as to the origin of the pronephric duct in Teleosts. Brook, G. 1888.1; Oellacher, J. 1872.1, 2.

Origin of Müllerian duct. In selachians as first discovered by Semper (Semper, C. G. 1874.1) and also independently observed by Balfour (Balfour, F. M. 1876.2, p. 20), the archinephric duct by a longitudinal splitting from before backward forms a dorsal duct (Wolffian, Leydig's or mesonephric duct) and a ventral duct to which Balfour limited the term, Müllerian duct. In males, the splitting is more partial and in general only parts of the Müllerian duct persist.

It is now generally accepted that, although differing in development, the Müllerian duct in all higher groups of vertebrates becomes the functional oviduct and is generally considered homologous throughout the vertebrate series. In the Teleost, however, the oviducts seem to be mainly ovarian in origin.

Balfour, however, believed that in the Teleosts also, the oviducts are modified Müllerian ducts and this view has at times gained some acceptance. This matter is further discussed below.

For full discussions of the origin of the Müllerian duct in Selachians, see Holzbach, E. 1909.1; Rabl, C. 1896.1; Rückert, J. 1888.2; Wijhe, J. W. 1888.1-1889.1.

In male Dipnoans, Müllerian ducts have disappeared in adults of Lepidosiren but persist in Protopterus. Kerr, J. G. 1901.1.

Müllerian ducts persist in adult males of Chimæra. Hyrtl, C. J. 1854.3.

Matthews records the presence (teratological) of a fully developed Müllerian duct on the left side of a male of Raja clavata. Matthews, J. D. 1885.1.

References to the Teleostean oviduct will be found below under Phylogeny of the Teleostean oviduct.

Opisthonephros inclusive of the mesonephros

A recent term, "opisthonephros," is defined by Prof. Kerr (Text-book, p. 221) as follows: "In many of the lower vertebrates there is no separation between mesonephros and metanephros, the two forming a continuous

structure which acts as the functional kidney. Such a type of renal organ, consisting of the series of tubules corresponding to mesonephros together with metanephros, may conveniently be termed the opisthonephros."

The opisthonephros forms the functional kidney in adults of all anamniotic vertebrates.

MORPHOLOGY BY GROUPS

Urinogenital system of Cephalochordata

In Amphioxus the chief renal organs consist of many (about 100) pairs of minute nephridia discovered independently by Boveri and by Weiss.

Structure of the excretory organs in Amphioxus. ★Boveri, T. 1890.1-1904.1; ★Goodrich, E. S. 1902.1, 2, 1903.1, 1909.1; Müller, W. 1875.1; Rolph, W. 1875.2; Weiss, F. E. Add. 1890.1.

Structure of the reproductive organs. Legros, R. 1896.1, 1909.1; Neikert, L. & Leiber, A. 1903.1; ★Zarnik, B. 1904.1, 1911.1.

Urinogenital system of Cyclostomata

Reproductive Organs

There is no connection between the excretory and reproductive organs in the Cyclostomata. The genital products (eggs and sperms) are liberated into the coelom and pass out through the genital pores.

Structure of reproductive organs in Bdellostoma. Cunningham, J. T. 1886.2.

Structure of reproductive organs in Myxine. Cunningham, J. T. 1887.2; Schreiner, K. E. 1904.1, 2; Weber, M. C. 1887.2, 3.

The reproductive organ of Myxine is said to possess the combined structure of ovary and testis (ovotestis) and to function as both, i. e., as a protandric hermaphrodite. For a further discussion, see under Hermaphroditism.

MYXINOIDES

Excretory Organs

The excretory system of the Myxinoids is the most primitive in craniates. The nephridial tubules develop as a continuous series, the intermediate tubules later degenerating (anterior remaining as pronephros) when the posterior part of the organ (mesonephros), extending over between twenty and thirty somites each with its tubule and Malpighian body, becomes the functional organ. Some workers (Semon, R. 1897.1) have considered the functional kidney to be a pronephros, but this view is now generally considered to be in error.

Structure and development of the excretory organs in Myxine. Joseph, H. 1905.1; Kirkaldy, J. W. 1894.1; Maas, O. 1897.2; Müller, W. 1873.2; Semon, R. W. 1897.1, 2; Semon, R. W. & Spengel, J. W. 1897.1; Spengel, J. W. 1897.1, 2.

Structure and development in Bdellostoma. Dean, B. 1899.6; Felix, W. 1897.2; ★Price, G. C. 1897.1-1910.1; Weldon, W. F. 1884.2.

A recent paper by ★J. L. Conel *on "The urinogenital system of Myxinoids" appears in the Journ. Morphol., 1917, vol. 29, pp. 75-138, 12 pls.*

Urinogenital Syst. — Cont'd.**PETROMYZONTES****Excretory Organs**

In the lampreys, the pronephros is most developed and functional in the larval *Ammocoetes* of 10 mm. length. The mesonephros is likewise functional in this stage and later develops to extend over about two-fifths of the body length.

Structure and development of the excretory organs in Petromyzon. Bujor, P. 1891.1; ★Hatta, S. 1897.2, 1900.1; Meyer, F. 1876.1; Müller, J. 1834.1 (v); Müller, W. 1875.1; Regaud, C. & Policard, A. 1901.1; Vialleton, L. 1890.1; ★Wheeler, M. W. 1899.1.

Urinogenital system of Dipnoi

Genito-urinary organs of breeding males of Lepidosiren and Protopterus. ★Kerr, J. G. 1901.1.

Urinogenital system of Lepidosiren and Protopterus. Ehlers, E. H. 1895.1; Kerr, J. G. 1902.2; Parker, W. M. 1888.2; Semichon, L. (Ovary) 1913.1.

Pronephros of Neoceratodus, development. ★Semon, R. W. 1901.3, 4, 6; Wilson, G. 1901.1.

Urinogenital system of Elasmobranchii

The most comprehensive treatise on the urinogenital system of the Elasmobranchii (text in French), including a review of the literature, is ★Borcéa, J. 1905.1.

A scholarly treatise in German, on the development of the urinogenital system of Selachii, is ★Rabl, C. 1896.1.

Other papers on the development are ★Balfour, F. M. 1874.1, 1876.2, 1878.2; ★Rückert, J. 1888.2, 1889.2; ★Semper, C. G. 1874.1–1875.3, Add. 1874.1; ★Wijhe, J. W. 1888.1, 2, 1889.1.

PLAGIOSTOMI**Reproductive organs**

Structure and development of the ovary in Selachii. Balfour, F. M. 1878.3; Giacomini, E. 1894.1, 1896.1; Rathke, M. H. 1827.1.

Ovarian follicle and corpus luteum of Spinax. Wallace, W. 1903.1.

Mechanism of hymen in Plagiostomes. Widakowich, V. 1908.1.

Older papers on the structure of the testis in sharks and rays. Hallmann, E. 1840.1; Martino, A. 1848.1; Müller, J. 1831.1; Stannius, F. H. 1840.1.

Miscellaneous early papers on the reproductive system of sharks, references in Pre-Linn. section. Belon, P. 1551.1; Collins, S. 1685.1; Duverney, J. G. 1733.2; Klein, J. T. 1740.1 (iii); Steno, N. 1675.1.

For an old but extensive account of the reproductive organs of Plagiostomes with an excellent review of the old literature, see Tilesius von Tilenau, W. G. 1802.1.

For the structure of the oviduct in adult Selachii, see Uterus below Viviparity under Reproduction.

For the manner of formation of the horny egg-cases of Elasmobranchii through secretion by the nidamental gland of the oviduct, see below Egg-cases under Ova and ovum.

Excretory organs

Older papers on the structure of the excretory organs in Selachii. Hyrtl, C. J. 1861.3; Meyer, F. 1875.1; Müller, J. 1842.1, 3; Steenstra-Toussaint, A. 1834.1–1839.2.

Morphology of mesonephros in numerous forms, Notidanus, Centrina, etc. Borcéa, J. 1904.1–1905.2.

The pronephros is never functional as an excretory organ.

Development of pronephros in Chlamydoselachus, Acanthias, and Scyllium. Brohmer, P. 1908.1; Haller, B. 1901.1; Laguesse, G. E. Add. 1891.3; Burlend, T. H. Add. 1914.1.

Occasionally, because of the influence of other viscera, there are variations in size; a dwarfed kidney may occur on one side, as recorded in Raja by Howes, G. B. 1890.4.

Although usually obliterated during development, as first noted by Semper, (entonnoirs segmentaires) open peritoneal funnels (incorrectly called nephrostomes) may persist throughout life in certain sharks such as *Cestracion*, *Scyllium canicula*, *S. stellare*, *Pristiurus*, *Spinax niger*, *Acanthias vulgaris*, *Scymnus lichia*, *Centrina salviani*, and *Rhina squatina*.

Structure and arrangement of the open peritoneal funnels. Borcéa, J. 1905.1; ★Guitel, F. 1897.1, 1900.2; Schneider, G. 1897.1; Semper, C. G. 1874.1–1875.3.

Bles believes that when the peritoneal funnels persist, the abdominal pores tend to be reduced and vice versa. ★Bles, E. J. 1898.1, 2.

Cloacal cavity of some Selachii, anatomy. Savouré, P. 1910.1.

In male Elasmobranchs, the anterior end of the mesonephros is glandular and entirely lacking in Malpighian corpuscles. It secretes a whitish fluid, variously considered to supply a nourishing medium for the spermatozoa or (in *Chimæra*) to dissolve the investments of the spermatozoa. It is known as Leydig's gland.

Structure and functions of Leydig's gland in sharks. Borcéa, J. 1904.1, 6, 1905.1; Disselhorst, R. 1904.1; Morgera, A. 1909.1.

HOLOCEPHALI

In Chimæra the gland just mentioned was first described as a "Nebenhoden," in Leydig, F. Add. 1851.1.

By Hyrtl, it was named Leydig's gland. Hyrtl, C. J. 1854.3.

Other papers describing this gland or the urinogenital system of Chimæra, are ★Burlend, T. H. 1910.1; Parker, W. N. & Burlend, T. H. 1909.1; Redeke, H. C. 1898.1.

Reproductive organs of Chimæra, especially ovaries and oviducts. ★Dean, B. 1906.1.

Vesiculæ seminales of male Callo-rhynchus. Parker, T. J. 1892.1.

Urinogenital System of Teleostomi

GANOIDEI

Morphology of the urinogenital system of Ganoidei in general. ★Hyrtl, C. J. 1854.2; Semon, R. W. 1891.1.

CROSSOPTERYGII

Development of pronephros in Calamoichthys. Jungersen, H. F. 1895.1; Lebedinsky, J. 1894.1.

Urinogenital organs of Polypterus. Jungersen, H. F. 1900.1.

Development of opisthonephros in Polypterus. Kerr, J. G. 1907.2.

CHONDROSTEI and HOLOSTEI

Development of embryonic cloaca, urinogenital sinus, and Müllerian duct in Acipenser. Ostroumov, A. A. 1906.1.

Development and structure of the pronephros in —Lepidosteus. Balfour, F. M. & Parker, W. N. 1882.1; Beard, J. 1895.2. — *Acipenser.* Jungersen, H. F. 1894.2. — *Amia.* Jungersen, H. F. 1894.1; Kupffer, C. W. 1893.1 (i).

In Ganoids, open peritoneal funnels persist only in Amia. Jungersen, H. F. 1894.1, 1900.1.

Preservation of remains of testis in fossil Eurycormus. Reis, O. M. 1894.2.

TELEOSTEI

Excretory Organs

In the Teleosts, the pronephros extends over about five segments, is functional in larval forms, and, except as stated below, is generally transitory.

For the most extensive treatise (in French) on the morphology of the Teleostean kidney, with a review of the literature, see ★Audigé, J. 1910.1.

Morphology and development of pronephros, mesonephros, and opisthonephros in Teleosts. Calderwood, W. L. 1892.3; ★Felix, W. 1897.1; Goette, A. 1875.1; ★Haller, B. 1908.2; ★Hyrtl, C. J. 1851.2; Parker, W. N. 1882.1; Rosenberg, A. 1867.1; Roule, L. & Audigé, J. 1908.1; Sobotta, J. 1895.1.

Morphology of the kidney in various forms. — *Cyprinidæ.* Gampert, O. 1866.1, 2. — *Lophobranchii.* Huot, A. 1897.1. — *Amiurus.* Mackenzie, T. 1884.1. — *Gastrostomus, Argyropelecus and Chauliodus.* Nusbaum-Hilarowicz, J. 1915.3. — *Clarias.* Weber, M. C. 1891.1.

Urinogenital organs of the male in Clarias. Panceri, P. 1874.1.

Persistence of pronephros. While generally transitory, the pronephros as represented by large functional glomeruli is said to persist in certain adult Teleosts. Emery described this condition as occurring in adults of *Fierasfer*, *Atherina*, *Mugil*, and *Zoarces*. After a controversy with Groszlik, he admitted that possibly his specimens of the three latter forms were immature but reaffirmed the existence of the pronephros in the adult of *Fierasfer*. The actual persistence of functional pronephric glomeruli

in Teleosts is doubted by Audigé and by Haller. For a full discussion of this subject, see Audigé, J. 1910.1, pp. 289-297.

Concerning the persistence of the pronephros in Fierasfer, see Emery, C. 1880.1, 1881.2, 1882.1, 1885.1; and Groszlik, S. 1885.1, 1886.1.

According to Guitel, the pronephros persists in various species belonging to the genera, *Chorisochismus*, *Lepadogaster*, *Caularchus*, *Gobiesox*, *Callyonymus*, *Gobius*, *Cottus*, *Aspidophorus*, *Trachinus*, *Blennius*, *Centronotus*, and *Atherina*. See ★Guitel, F. 1900.1, 1901.1-1908.1, 1910.1, 1912.1, 1913.2.

Urinary bladder. The urinary bladder in Teleosts is constituted by the part formed through the posterior fusion of the two archinephric ducts, together with the terminal part derived from the cloaca.

Structure of urinary bladder in — *Barbus.* Audigé, J. 1904.3. — *Trachinus.* Chaine, J. 1909.1. — *Absence in certain fishes.* Hyrtl, C. J. 1849.1. — *Development.* Kupffer, C. 1868.1. — *Relation to cloaca.* List, J. H. 1889.1. — *Urinary canal.* Policard, A. & Mawas, J. 1906.1.

For the chemical composition of the urine of fishes, see under Chemistry.

Reproductive Organs

For all reproductive or breeding and mating habits, see under Reproduction.

For the occurrence of genital organs of both sexes in the same individual, see under Hermaphroditism.

For the reproductive elements, see Ova and ovum and Spermatozoa.

For the origin and migration of the germ cells, see that subject under Embryology.

Reproductive organs, morphology and development. ★Böhi, U. (*Salmonidæ*) 1904.1; Brock, J. 1878.1, (*Muraenoids*) 1881.1; ★Weber, M. C. 1886.1; Cunningham, J. T. (*Solea*) Add. 1888.2.

Studies on the ovaries of fishes, anatomical histological, etc., chiefly made in connection with studies on the development of the ovarian ova. *Structure in —* *General.* Auerbach, L. 1891.1; Calderwood, W. L. 1892.1; Cunningham, J. T. 1893.9, 1897.3, 1898.1. — *Lophius and Zeus.* Fulton, T. W. 1898.3. — *Lophius.* Mocquard, F. Add. 1888.1. — *Gobius minutus.* Guitel, F. 1892.3. — *Lucifuga and Stygicola.* Lane, H. H. 1903.1, 1908.1, 1909.1. — *Clupea.* Loewe, Fr. 1896.1. — *Anarrhichas.* McIntosh, W. C. 1885.2. — *Lophobranchii.* MacLeod, J. 1881.1, 2, 3. — *Labrax.* Roule, L. 1914.7. — *Zoarces.* Stuhlmann, F. L. 1887.1. — *Engraulis.* Weber, M. C. 1886.2, 3. — *Sebastes and Sparus.* Williamson, H. C. 1911.4. — *Ophidium.* Hyrtl, C. J. Add. 1849.1.

Phylogeny of the Teleostean oviduct. The homologies of this duct, i. e., whether or not it is a Müllerian duct as above defined, are still debatable points in morphology.

Prof. J. G. Kerr in the "Encyclopædia Britannica" (1910, vol. xiv, p. 256), wrote as follows: "In the great majority of Teleosts and in *Lepidosteus* the oviduct possesses no coelomic funnel, its walls being in structural continuity with the wall of the ovary. In most of the primitive Teleostomes (Crossopterygians,

Urogenital Syst. — Cont'd.

sturgeons, *Amia*) the oviduct has at its front end an open coelomic funnel, and it is difficult to find adequate reason for refusing to regard such oviducts as true Müllerian ducts. On this interpretation the condition characteristic of Teleosts would be due to the lips of the oviduct becoming fused with the ovarian wall, and the duct itself would be a Müllerian duct as elsewhere."

More recently Professor Kerr (Textbook, 1919, p. 278) in contrast with the above statements has formulated the following views regarding the Teleostean oviduct.

(1) The primitive oviduct or *Müllerian duct* gradually atrophied until eventually nothing was left but its external opening, the genital pore.

(2) The splanchnocœle along the ovigerous surface became enclosed by peritoneal folds, the anterior part of this cavity remaining fertile, the elongated posterior portion becoming sterile and serving simply as a conducting tube for the ova (oviduct).

(3) The posterior lips of this *secondary oviduct* became fused with the edges of the genital pore, which thus *again* becomes the oviducal aperture.

These divergent views adequately represent the alternative theories regarding the nature of the Teleostean oviduct.

The latter type of oviduct, considered non-homologous with the Müllerian duct, has been termed *ovary-duct* by Howes, (G. B. 1891.1, p. 551).

Various papers describing the structure and development of the oviducts in various Teleosts are Böhi, U. 1904.1; Cunningham, J. T. 1887.3; ★Haller, B. 1905.1; Howes, G. B. 1891.1,2; Huxley, T. H. 1883.2; ★Lickteig, A. 1913.1; MacLeod, J. 1881.3; Nussbaum, M. 1880.1; Nussbaum-Hilarowicz, J. 1915.1; Prince, E. E. 1887.1; Rathke, M. H. 1820.2; Schneider, G. 1894.1, 1895.2; Vogt, C. C. 1882.2; Weber, M. 1886.1.

The Teleostean oviduct arises as a peritoneal derivative formed after the differentiation of the ovary, and it subsequently becomes connected with the ovarian investment, according to ★Jungersen, H. F. 1889.1 (p. 179), who believes that the Teleostean oviduct may be regarded as a modified Müllerian duct.

The view which has long been held that oviducts are absent in Salmonidæ (Rathke, M. H. 1820.2; Weber, M. 1886.1) is considered erroneous by W. C. Kendall (Bull. U. S. Bur. Fish., 1921, vol. xxxvii, p. 189), who describes an oviducal trough formed by the ovarian investments.

VARIATION

This section includes only detailed statistical studies, by the examination of large numbers of individuals, on the occurrence or frequency of variation in certain characters chosen for study, such as the number of scales, fin rays, color markings, etc.

These studies were largely influenced by the concept of Bateson with regard to discontinuity in the origin of species.

For references to all abnormal variations in structure, see under Teratology.

Other references to slight variations within the species will be found under the various families and genera.

Materials for the study of variation. ★Bateson, W. 1894.1. — *Method for the expression of measurements.* Camerano, L. 1900.1, 1901.1. — *Progressive reduction of variability.* Rosa, D. 1903.1.

Miscellaneous papers on variation. Bumpus, H. C. 1898.6; Eigenmann, C. H. 1892.7; Eigenmann, C. H. & Kennedy, C. H. 1903.2; ★Fatio, V. 1877.1, 1899.1; Heincke, F. 1892.1; Meek, S. E. 1900.3; Nichols, J. T. 1911.2, 1916.5; Walton, L. B. 1907.1.

Detailed researches on the variation in various chosen characters have been made as follows. — *Pilchard.* Bateson, W. 1894.3. — *Flounder.* ★Duncker, G. 1895.1,2, 1896.1, 1900.2. — *Review of this work.* Stead, F. B. 1897.4. — *Acerina.* Duncker, G. 1897.1. — *Siphonostoma.* ★Duncker, G. 1908.1. — *Leuciscus balteatus.* Eigenmann, C. H. 1895.2. — *Mullus.* ★Fage, L. 1909.1. — *Mackerel.* Garstang, W. 1897.3, 1898.1. — *Herring.* ★Heincke, F. 1877.1. — *Percina caprodes.* ★Moenkhaus, W. J. 1893.1–1898.1. — *Petromyzon.* Rosmini, O. 1901.1. — *Tench.* Segre, R. 1902.1. — *Triglidae.* Tillier, L. 1879.2. — *Pimephales notatus.* Voris, J. H. 1899.1. — *Gasterosteus.* Heincke, F. Add. 1889.1.

Meristic variation in Asymmetron and Heteropleuron. Punnett, R. C. 1903.1.

Statistical studies on fish races. Redeke, H. C. 1902.1, 1912.2.

For the recent statistical racial studies of J. Schmidt, involving breeding experiments, see Genetical work under Hybrids.

VERTEBRAL COLUMN

Comprising the development and structure of the notochord, the chordal sheath, the arcualia, the centra and the definitive vertebræ.

For cases of palistrophy (coalesced vertebræ) notochordal reduplications, spinal curvature, etc., in fishes, see below Abnormalities of skull and vertebral column under Teratology.

For the vertebral theory of skull origin, see under Skull.

For the termination of the vertebral column in the tail of fishes, see below Caudal fin under Fins.

For the coalescence of the anterior vertebræ with the occipital region of the skull and the transformation of certain parts into the Weberian ossicles, see Weberian apparatus under Auditory organs.

For the most illuminative treatise in English on the development and morphology of the vertebral system in all groups of fishes, see ★Gadow, H. & Abbott, E. C. 1894.1.

This has served as a basis for the readable chapter in ★Bridge, T. W. 1904.1.

Comprehensive treatises in German, relating to development and morphology in all groups of vertebrates. ★Goette, A. 1878.1 and ★Schauinsland, H. Add. 1905.1.

VARIOUS TOPICS

Papers on the notochord: development, histology and histogenesis, phylogeny, etc. Boeke, J. 1902.4; Henneguy, L. F. 1907.1;

★Kemna, A. 1904.1; Masterman, A. T. 1898.1; Mayer, A. F. 1865.1; Retzius, M. G. 1881.1; Schaffer, J. 1901.2 (iii), 1910.1; ★Studnička, F. K. 1897.2,3, 1902.1, 1903.2; Valenti, G. 1898.1; Müller, W. Add. 1871.1 (i).

Hypochord, or sub-notochordal rod. — *Development in teleosts.* Franz, K. 1897.1. — *In Raja.* ★Gibson, W. T. 1909.1. — *Morphological significance.* Klaatsch, H. 1897.2. — *Origin, Selachii.* Weber, A. 1913.1.

Relations of temperature to number of vertebræ. Jordan, D. S. 1892.2, 1893.2, 1894.3. — *Mode of union of vertebræ after fracture, Solea.* Yarrell, W. 1835.1.

Various papers on the development, morphology, phylogeny, etc., of the vertebral column. (The forms to which they relate are not indicated in the titles.) Baur, G. H. 1886.1; Dormitzer, M. 1852.1; Dollo, L. 1893.2; Geoffroy-Saint-Hilaire, E. 1821.1, 1822.1,3; ★Gaupp, E. 1897.1; Hay, O. P. 1896.2, 1897.1,2; Home, E. 1809.2; Ihering, H. 1878.2; Jaekel, O. 1904.2; Lavocat, A. 1884.1, 1885.1; Müller, A. 1853.1; Spencer, H. 1900.1; Stannius, F. H. 1849.2; Suster, M. 1899.1; Welcker, H. 1878.1; Bruch, C. Add. 1862.1,2; Cartier, O. Add. 1875.1; Schultze, C. A. Add. 1818.1.

Notochordal sheath

The cuticular product of the notochord which it surrounds; composed of the *Elastica Interna* or original border of the chorda, the secondary sheath often invaded by cartilage cells, and the *Elastica Externa* (primary sheath) or outermost boundary of the entire chordal sheath.

Development, structure, etc. Ebner, V. 1896.6,7; Kölliker, R. A. 1860.2; Lvov, V. N. 1887.1; Perenyi, J. 1887.1; Schneider, O. 1913.1; Claus, C. Add. 1894.1.

History of investigations of the notochordal sheath. Kölliker, R. A. Add. 1872.1.

VERTEBRAL COLUMN

Morphology in various groups of fishes

Following Gadow and Abbott we are able to distinguish two types in the formation of the centra or bodies of the vertebræ.

I. "*Chorda-centra, i. e., centra formed by the entire chordal sheath, which itself has been strengthened by invasion of cartilaginous cells from the skeletogenous layer. Chorda centra are possessed by all Elasmobranchs, potentially by Dipnoi and Holocephali.*"

II. "*Arch-centra, i. e., centra formed by the skeletogenous mass which remains entirely on the outside of the chordal sheath, which latter takes no share in their formation: osseous Ganoids and Teleostei.*"

Cephalochordata

In this group, the vertebral axis is composed of the primitive notochord.

Structure and development of the notochord in Amphioxus. Ebner, V. 1896.2; Harting, P. 1879.2; Kossmann, R. A. 1873.1; Lubach, D. 1870.2; Lvov, V. N. 1893.2, Add. 1891.1, 1892.1; Moreau, E. 1870.1,2, 1875.1; Pouchet, G. 1881.2; Renault, J. & Duchamp, G. 1878.1; Repiachoff, W. 1883.1; Retzius, M. G. 1891.1; Rolph, W. 1875.1; Joseph, H. Add. 1895.1; Mihalkowics, V. Add. 1876.1.

Cyclostomata

A persistent acentrous notochord; the skeletogenous layer remains outside the *elastica externa* so that the chordal sheath remains entirely chordagenous. Dorsal processes probably representing basi- and inter-dorsals. No ventral arcualia.

Structure and development, chiefly in Petromyzon. Calberla, E. 1877.2; Ebner, V. (*Myxine*) 1896.3,5; Geoffroy-Saint-Hilaire, E. 1821.1; Goette, A. 1878.1,4; Hasse, J. C. 1894.1; Pérepele, K. 1878.1; Retzius, M. G. 1892.2; Schneider, A. F. 1879.1 (p. 51); Scott, W. B. 1882.1.

Arthrodira

In Dinichthys, the vertebral column consists of slightly calcified neural and hæmal arches and a persistent notochord. Dean, B. 1896.7.

Elasmobranchii

In this group the centra (chordacentra) are formed by the conversion of the chordal sheath into a series of ring-like cartilaginous segments which replace the notochord. The centra may become calcified but true bone is never developed.

Structure and development of the vertebral column; composition of the definitive vertebræ, etc. Gadow, H. 1900.1; ★Hasse, J. C. 1876.1, 1877.1, 1878.1, 1879.1,2, 1892.2; ★Kölliker, R. A. 1860.2,7, 1864.1; Müller, J. 1837.1; Müller, J. & Agassiz, L. 1843.1; Perenyi, J. 1887.1, 1889.1; Rosenberg, E. W. 1884.1; ★Sécerov, S. 1911.1; Stark, James. 1844.2.

For fine figures of the vertebral column of various Elasmobranchs see Garman, S. 1913.1.

HOLOCEPHALI

Centra are not formed in the Holocephali.

Structure of vertebral column in Holocephali (Chimæra). Gegenbaur, C. 1898.1; Hasse, J. C. 1879.1; Howes, G. B. 1902.1; Schultze, C. A. 1818.1.

Teleostomi

CHONDROSTEI (Cartilaginous Ganoids)

"The chorda shows uniform and persistent growth throughout life. The skeletogenous layer remains restricted to the outside of the *elastica* and produces dorsal and ventral arcualia which remain laterally asunder, being there connected by the *membrana reuniens* only."

Vertebral Column — Cont'd.

This quotation concerning Acipenser is from Gadow, H. & Abbott, E. C. 1894.1.

Histology of chorda in Acipenser. Ebner, V. 1896.4.

HOLOSTEI

(Osseous Ganoids)

In this group, osseous arch-centra are formed.

Structure and development of vertebral column. Hasse, J. C. 1894.2.

Structure and development in Amia calva. ★Hay, O. P. 1895.3; Ihering, H. 1878.2; Schmidt, L. 1892.1.

Structure and development in Lepidosteus. (This form is unique among fishes in possessing opisthocœlous vertebræ.) Balfour, F. M. & Parker, W. K. 1882.1; C., E. 1868.1; ★Gegenbaur, C. 1867.1.

The older groups "Amioidei" and "Lepidosteioidei" were rejected by Woodward and the genera partly redistributed into new suborders, the Protospondyli and the Ætheospondyli, based on the structure of the vertebral column. For a discussion of their taxonomic status, see Hay, O. P. 1898.1, 6.

Much information on the vertebral column of fossil ganoids will be found in Woodward, A. S. 1889.2, and in Zittel, K. A. 1887.1.

TELEOSTEI

(Bony fishes)

"The centrum is formed entirely by the skeletogenous layer remaining outside the elastica, its cartilage is derived from the dorsal and ventral arcualia." This cartilage surrounds the chordal sheath with a complete mantle (Rhodeus), and is ossified later on. In the trout, most of the material necessary for the formation of the centrum is indifferent membrana reuniens and ossifies directly.

Papers primarily on the development of the vertebral column in teleosts. Albrecht, A. 1902.1; Alessi, C. (Clupeidæ) 1898.1; Calberla, E. 1877.2; Goette, A. 1873.1 (v), 1878.4; Goronowitsch, N. (Salmonidæ) 1885.1; ★Grassi, G. B. 1883.1–1885.1; ★Klaatsch, H. 1892.1; Lotz, T. 1864.1; Reinhard, W. (Cyprinoids) 1888.1; Roule, L. 1908.3; ★Scheel, C. 1893.1; Sella, M. (Murænidæ) 1911.2; ★Stéphan, P. 1898.1, 1900.1; ★Ussow, S. A. 1900.1, 1906.1; Wyman, J. 1856.2.

Structure or morphology of the vertebral column or the definitive vertebræ. — Teleostei. Battista, G. 1883.1. — Doras. Bliss, R. 1872.2. — Muræna. Ciamician, J. 1878.1. — Cobitidæ. Grobben, C. 1875.1. — Clupeidæ. Lombardo, A. C. 1884.1.

Absence of true articular apophyses, teleosts. Alix, E. 1874.1. — Cervical and occipital vertebræ of Teleosts. Robertson, C. 1861.1.

Dipnoi

Chordal sheath strengthened by invasion of skeletogenous cells, therefore with possibility of chorda-centra, but the

partly chondrified chordal sheath remains unsegmented, i. e., no centra are formed.

Structure in Dipnoi. Günther, A. C. 1871.3; Hasse, J. C. 1892.1; Klaatsch, H. 1893.1; Wiedersheim, R. E. 1880.2.

VISCERAL SKELETON

Comprising the structure of the visceral and branchial arches. Although primitively cartilaginous, in the Teleostei these parts are ossified as cartilage bones. The visceral skeleton consists of a series of supporting bars, the visceral arches, arising in the mesenchymatous tissue between the visceral clefts. The two anterior visceral arches are specially designated, the first is the mandibular and the second is the hyoid arch. The remaining arches are collectively called branchial or gill arches.

For the musculature of the visceral arches, see Cranial and visceral muscles under Myology.

Embryonic development of the visceral arches, their topographic role, etc. Braus, H. 1904.2; ★Dohrn, F. A. 1882.2 (vii); Froriep, A. 1891.1; ★Vialleton, L. 1908.2. — Development in Lepidosiren and Protopterus. Agar, W. E. 1906.1. — Selachii. ★Gibian, A. 1912.1. — Syngnathus. McMurrich, J. P. 1883.1. — Sharks and skates. ★Parker, W. K. 1879.2. — Acanthias. ★Severtzov, A. N. 1899.1. — Teleostei. Voskoboïnikov, M. M. 1910.1. — Salmo. Zanichelli, W. 1909.1.

Morphology of the visceral skeleton or "Ligamentum denticulatum" of Amphioxus. Benham, W. B. 1893.1; Rolph, W. 1875.2.

Morphology of the visceral skeleton of Cyclostomata, chiefly Petromyzon, the so-called "hyobranchial skeleton" or "branchial basket." Alix, E. 1880.1; Ayers, H. & Jackson, C. M. 1900.1; Burne, R. H. 1892.1; Dohrn, F. A. 1882.2 (v); ★Huxley, T. H. 1876.2; Kupffer, C. W. 1895.1; Neumayer, L. 1910.1; ★Parker, W. K. 1883.1; Schaffer, J. 1901.2; Severtzov, A. N. 1914.1; Gaupp, E. Add. 1904.1.

Morphology of the visceral skeleton in adult Selachii. ★Fürbringer, K. 1903.1; ★Gadow, H. 1888.1; Garman, S. (Fine figures) 1913.1; ★Gegenbaur, C. 1864.2 (iii); Molin, R. 1859.1. — Chlamydoselachus. Goodey, T. 1910.1. — Echinorhinus. Ridewood, W. G. 1899.1. — Læmarigus. White, P. J. 1893.1. — Pristiophorus. ★Hoffmann, L. Add. 1914.1.

Morphology of the visceral skeleton in the Chimæroid or "holocephalic" skull. Dean, B. 1906.1; Hubrecht, A. A. 1876.1; Woodward, A. S. 1889.2 (ii).

Morphology of visceral skeleton in Ganioidei and Neoceratodus. ★Wijhe, J. W. 1880.1, 1882.1.

Morphology of visceral skeleton in Symbranchidæ. Weyenbergh, H. 1878.4, 1881.1.

Relations of mandibular and hyoid arches in Hybodus. Woodward, A. S. 1886.3.

Derivatives of mandibular and hyoid arches with especial references to the homologies of the mammalian auditory ossicles. Albrecht, P. 1884.1; Gadow, H. 1888.1; Debierre, C. Add. 1885.1.

Visceral arch theory of origin of jaw. Jaekel, O. 1905.1, 1906.4, 1907.1.

Labial cartilages of sharks, often considered remnants of pre-mandibular arches. Pollard, H. B. 1895.3.

Suggestion of former existence of an arch and an additional visceral cleft between mandibular and hyoid arches. Beard, J. 1885.2; Dohrn, A. 1882.2 (vii); Wijhe, J. W. 1882.2.

*Existence of skeletal elements between the mandibular and hyoid arches in *Lamargus* and *Hexanchus*.* White, P. J. 1895.1.

HYOID ARCH

*Anatomy of the hyoid arch in *Neoceratodus*.* Ridewood, W. G. 1894.1.

Anatomy of the "tongue-bone," being the median basi-hyal element of the second visceral or hyoid arch. Budge, J. (*Sphyræna*) 1848.1; Dohrn, F. A. 1882.2 (vii); Eichwald, C. E. 1833.1; Geoffroy-Saint-Hilaire, E. 1817.3, 1832.1.

For the fleshy tongue, see below Oral cavity under Alimentary canal.

For the conditions of the suspension of the lower jaw to the hyomandibular or proximal sector of the hyoid arch, see under Skull. See especially ★Gregory, W. K. 1904.2.

Branchial or gill arches

*Development in *Selachii*.* ★Dohrn, F. A. 1882.2 (ix, xi, xii). — *Phylogeny.* Gaskell, W. H. 1898.1 (iii). — *Development.* Remak, R. 1855.1.

*Structure in — *Muraenidæ*.* Popta, C. M. 1904.1. — *Dentex.* Vinciguerra, D. 1893.4.

*Presence of vestigial sixth and seventh arches, respectively in *Notidanus* and *Chlamydoselachus*.* Hawkes, (Mrs.) O. A. 1905.1, 1907.1.

Gill rakers: cartilaginous or bony filaments on the inner side of the branchial arches. — Comparative studies on their structure in various fishes. Popta, C. M. 1901.2, 3; Troschel, F. H. 1849.2; ★Zander, E. 1903.2, 1906.1, 2.

*Although forming a straining mechanism in all fishes, in some genera they form an exceptionally close-set branchial sieve. Such structure in — *Polyodon*.* Imms, A. D. 1904.1. — *Rhineodon.* Lütken, C. F. 1874.2. — *Basking shark (*Cetorhinus*).* Allman, G. J. 1876.1; Bocage, J. V. 1878.1; Day, F. 1885.3; Hendricks, K. 1908.1, 1909.1; Leriche, M. 1908.8; Pavesi, P. 1874.1; Steenstrup, J. J. 1873.1, 1875.1; Turner, W. 1879.2; Macalister, A. Add. 1879.1. — *Mobula.* Vaillant, L. L. 1912.1.

*Extrabranial cartilages of *Elasmo-* branches.* Foote, E. 1895.1; Fürbringer, M. 1903.2; Ridewood, W. G. 1897.1; White, P. J. 1896.1.

For the branchial filaments, see Gills under Respiratory organs.

For the interbranchial or respiratory muscles, see Cranial and visceral muscles under Myology.

For the "branchial arch hypothesis" of the origin of limbs (Gegenbaur's view), see Phylogenesis of limbs under Evolution.

Visceral clefts

Called also pharyngeal, branchial, and gill clefts.

Development of the visceral clefts. ★Dohrn, F. A. 1882.2 (xxiii, xxiv); Masterman, A. T. 1898.1; Spengel, J. W. 1904.1; Vialleton, L. 1906.1.

Additional references to such development will be found under Head.

Presence of seven visceral clefts in shark embryos. Bemmelen, J. F. 1886.1.

*Arrangement, *Selache maxima*.* Jaekel, O. 1890.1.

For the hyomandibular cleft, i. e., cleft between mandibular and hyoid arches, a functional vestige in fishes when present, see Spiracle under Respiratory organs.

For Dohrn's theory of the origin of the mouth through the coalescence of a pair of gill clefts see Oral cavity under Alimentary canal.

VISION

For the organ of vision, see Eye.

For "color vision," see Color perception under Behavior.

For the influence of vision on Changes in Coloration, see under Coloration.

For the latest and most comprehensive papers on vision in fishes, see Baglioni, S. 1910.1; ★Hess, C. 1911.1, 1913.1, Add. 1912.1, 1914.1; Tschermak, A. 1915.1.

Miscellaneous items. Franz, V. 1907.4; Fripp, H. E. 1866.1; Henshall, J. A. 1878.1; Jeffries, B. J. 1869.1; Milewski, A. 1915.11; Plateau, F. A. 1866.1, 2; Reinhardt, L. 1902.1; Ward, F. 1908.1; Brunton, J. Add. 1882.1; Edwards, G. Add. 1763.1; Lanik, A. Add. 1914.1; Vigueron, H. Add. 1913.1; Wernicke, O. Add. 1895.1.

Various researches, chiefly experimental. — Binocular vision. Apgar, A. C. 1886.1; ★Tschermak, A. 1902.1, 1914.1. — *Subaqueous vision.* Dudgeon, R. E. 1871.1; Wood, R. W. 1906.1, Add. 1906.1. — *Vision, deep-sea fishes.* Chun, C. 1893.1. — *Influence of vision on movements, *Mustelus*.* Parker, G. H. 1910.2.

Rheotropism considered an optical reflex. Lyon, E. P. 1905.1, 1909.1.

For effects of excision of eye upon coloration, see under Coloration. See especially Buijtendijk, F. J. 1911.1; Lubach, D. 1864.2; Pouchet, G. 1877.1, 1879.1.

Accommodation in vision. *In fishes accommodation is accomplished through the pulling inward and backward or retinalward of the lens by the muscle named by Beer, *Musculus retractor lentis*, which is formed by the *Processus falciformis*, a median prolongation of the choroid and its expanded outer portion, the *Campanula Halleri*.*

General accounts, including physiological researches. ★Beer, T. 1894.1, 1898.1; Brass, A. 1881.1; Deichsel, G. 1908.1; Franz, V. 1905.1, 1910.3; Pflugk, A. 1911.1; ★Sicherer, O. 1911.1; ★Hess, C. Add. 1912.1.

Vision — *Cont'd.*

Discovery of the muscle of accommodation. Dalrymple, J. 1838.1; Leydig, F. 1852.1; Manz, W. 1858.1, Add. 1857.1; Wallace, W. C. 1834.1, 1835.1, 1838.1.

Tensor muscle of choroid in teleosts, homologous with the ciliary muscles which effect accommodation in higher vertebrates. Structure. Grynfeldt, E. 1908.1–1910.4. — *Ciliary muscle considered lacking.* Lee, R. J. 1869.1.

VIII

SUBJECT INDEX

SYSTEMATIC SECTION¹

CEPHALOCHORDATA (LEPTOCARDII OR LANCELETS)

Marine acraniate fish-like chordates.

General treatise. Delage, M. Y. & Hérouard, E. 1898.1; Willey, A. 1894.1.

Classification and geographical distribution. Tattersall, W. M. 1903.1. — *For a map showing the geographical distribution of the Cephalochordata, see* Herdman, W. A. 1904.1 (p. 138).

Taxonomy of forms from — Maldivé and Laccadive Islands. Cooper, C. F. 1903.1; Parker, G. H. 1904.3. — *Japan.* Jordan, D. S. & Snyder, J. O. 1901.12. — *Ceylon.* Tattersall, W. M. 1903.2.

Family Amphioxididæ

Amphioxides (A pelagic form). *Taxonomy and relationships.* ★Goldschmidt, R. 1905.1, 1906.1, 1909.1, Add. 1905.1. — *Review of the above.* Willey, A. 1906.1.

Family Branchiostomidæ

Marine littoral forms

Taxonomic revisions of genera and species. Gill, T. N. 1895.2; Jordan, D. S. & Snyder, J. O. (Japan) 1901.12; ★Kirkaldy, J. W. 1895.1, Add. 1894.1.

Amphioxus (Branchiostoma). *Natural history, descriptions of young, etc.* Bert, P. 1867.1, 5; Clark, H. J. 1865.1; Harting, P. 1876.1; Kemna, A. 1906.1; Krause, W. 1898.1; Lindsay, A. 1857.1; Müller, J. 1839.1, 1841.2; Quatrefages, J. L. 1845.1; Reichert, C. B. 1870.1; Rice, H. J. 1878.1; Schultze, M. J. 1851.1; Schneider, A. F. 1878.1; Sundevall, C. J. 1840.1; Sundewall, F. 1843.1; Willey, A. 1891.1, 1901.1; Yung, E. J. 1906.1; Putnam, F. W. Add. 1865.1.

Phylogenetic relationships. — Relation to Balanoglossus. MacBride, E. W. 1897.1.

— *Amphioxus a slightly metamorphosed tunicate (with consideration of homologies).* Wijhe, J. W. 1906.1, 1914.1, 2. — “*Amphioxus and the ancestry of the vertebrates.*” Willey, A. 1894.1.

Asymmetron. *Natural history notes.* ★Andrews, E. A. 1893.1; Benham, W. B. 1901.1, 1901.2; Mark, E. L. 1904.1; Römer, F. 1896.1; Willey, A. 1896.1.

Epigonichthys. *Natural history.* Harting, P. 1877.1; Passzlavsky, J. 1877.1; Peters, W. C. H. 1876.1.

CRANIATA

Animals (Vertebrate) distinguished by the possession of a definite “head.”

CLASS CYCLOSTOMATA, OR MARSIPOBRANCHII.

Aquatic craniates without true jaws.

For parasitic habits of Cyclostomes, see under Parasitic Fishes, also pp. 416 and 500.

Natural history. Duméril, A. M. 1812.1, 2; Partiot, L. Add. 1848.1; Thomson, J. A. Add. 1912.1.

Taxonomy and systematic relationships. Dean, B. 1900.1; Gill, T. N. 1883.7; ★Howes, G. B. 1892.1; Woodland, W. N. 1911.4. — *Supposed gnathostome ancestry of Marsipobranchii.* Woodland, W. N. 1913.2.

Taxonomy of species found in — Russia. Berg, L. S. 1906.10. — *Japan.* Jordan, D. S. & Snyder, J. O. 1901.12. — *Australia.* Ogilby, J. D. 1896.2.

ORDER MYXINOIDES

(Hyperotreti)

Hag-fishes or Borers

For a map showing the geographical distribution of the Myxinoides, see Meek, A. 1916.1 (p. 31).

¹ Arranged in general according to the system used in the Cambridge Natural History — this for convenience.

Confined chiefly to natural history, occurrence and the larger and more recent papers on fossil forms and taxonomy. Rarely going below genera, save in the case of the fishes of great economic as well as scientific importance (i. e. *Anguilla*, *Pleuronectidæ*, *Salmonidæ*, etc.).

For further data on natural history, see *Habits, Reproduction, etc., in Morphological Section.* For further references to fossil fishes, see the elaborate section *Palæontology*, also Hay, O. P. 1902.1, and Woodward, A. S. 1889.2, and also the *Bibliography of North American Palæontology cited in Part IV, General Bibliographies.* For further data on taxonomy and occurrence, see section *Fauna of the World*, and for particular regions, see such great faunistic and taxonomic works as Day, F. 1875.1, Boulenger, G. A. Add. 1909.1, Eigenmann, C. H. 1912.2, Goode & Bean, 1896.1, Jordan & Evermann, 1896.1. For new species, see *Zoological Record.*

For all other subjects, see the *Morphological Section.*

Taxonomy. Dean, B. (*Japanese forms*) 1904.7; Fürbringer, M. 1900.1; Gill, T. N. 1883.5.

Family Myxinidæ

General account. Retzius, M. G. 1895.1.

Myxine. — *Natural history.* Gunner, J. E. 1766.6; Steenstrup, J. J. 1865.2; Swartz, O. 1790.1. — *Taxonomy; revision.* Regan, C. T. 1913.20.

Family Bdellostomatidæ

Taxonomy. Gill, T. N. 1883.5, 1894.1.

Bdellostoma. — *Nomenclature.* Gill, T. N. 1901.1. — *Taxonomy.* Putnam, F. W. (*Revision*) 1874.5; Regan, C. T. (*Synopsis*) 1912.23.

ORDER PETROMYZONTES

(*Hyperoarti*)
Lamprey Eels

Taxonomy; synopsis. Regan, C. T. 1911.16.

Family Petromyzontidæ

Natural history. Agassiz, J. L. & Cabot, J. E. 1850.1; Fowler, H. W. 1907.3; Gage, S. H. & Meek, S. E. 1886.1; Surface, H. A. 1898.1, 1899.1.

Taxonomy. General accounts. Agassiz, J. L. 1850.5; Gill, T. N. 1883.8, 1895.6; Goode, G. B. 1883.8; Jordan, D. S. & Gilbert, C. H. 1884.4.

Taxonomy; forms in — *Russia.* Berg, L. S. 1907.5; Gracianov, V. I. 1907.3, 1907.6. — *Japan.* Hatta, S. 1901.1. — *Sweden.* Malm, A. W. 1860.1, 1863.2. — *Southern Hemisphere.* ★Plate, L. H. 1902.1. — *Australia.* Leach, J. A. Add. 1914.1.

Ammocætes (*the larval form of Petromyzon*). — *Natural history.* Cederström, G. C. 1861.1; Holfert, H. F. 1870.1; Meek, S. E. 1890.2. — *Evolutionary history.* Gaskell, W. H. 1898.1 (viii).

Metamorphosis of Ammocætes into Petromyzon. Baur, A. 1867.1; Benecke, B. 1880.3, 7; ★Bujor, P. 1891.1, 2; Gage, S. H. 1891.1, 1893.2, 1894.1, 1898.1, 1899.1; ★Kaensche, C. C. 1890.1.

See also p. 368.

Genera found only in northern waters

For a map showing the geographical distribution of the northern *Petromyzontidæ*, see Meek, A. 1916.1 (p. 28).

Entosphenus (*Entersphenus*). *Popular account.* Smith, H. M. 1900.3.

Lampetra. *Natural history.* Loman, J. C. 1912.1.

Occurrence — *in Kamchatka.* Berg, L. S. 1912.5. — *in New Jersey.* Davis, W. T. 1915.1. — *in Siberia.* Hatta, S. 1901.1. — *in Cayuga lake, N. Y.* Meek, S. E. 1886.1; Surface, H. A. 1898.1. — *at Ann Arbor, Michigan.* Schaffner, D. C. 1902.1.

Petromyzon. *Natural history, including descriptions, notes, etc.* Bentivoglio, T. 1895.1; Berthier, V. 1908.1; Ceder-

ström, G. C. 1862.1; Ferry, L. 1883.1; Frauen, M. 1879.1; Gage, S. H. 1891.1; ★Geisenheyner, L. 1911.1; Gulliver, G. 1870.1; Hilgendorf, F. M. 1890.1; Holland, (Maj.) — 1870.1; Kouliabko, A. 1897.1; Larbalétrier, A. 1898.1; Leonhardt, E. E. 1903.7; Lubosch, W. 1902.1; Moller, A. F. 1897.1; Nau, B. S. 1787.1; Pollen, F. P. 1871.6; Redeke, H. C. 1901.1; Roy, E. 1906.1; Smith, John A. 1863.6; Surface, H. A. 1898.1; Tilden, J. 1815.1; Anon. 391, 432; Blanc, H. Add. 1890.1.

Variations. Hatta, S. 1911.1; Rosmini, O. 1901.1. — *Identity of P. planeri and P. fluviatilis.* Wajgel, L. 1883.1.

Genera found only in southern waters

Geotria. *Natural history.* Berg, C. 1893.1; Dendy, A. & Olliver, M. F. 1902.1; Gray, J. E. 1851.2; Roché, G. 1893.2.

Macrophthalmia. *Natural history, taxonomy, etc.* Dean, B. 1899.7; Plate, L. H. 1897.1; Philippi, R. A. 1865.1; Prometheus. 1899.2; Steuber, N. J. 1905.1.

Mordacia. *Natural history notes.* Gill, T. N. 1893.5, 1895.6; Hall, E. S. 1865.1.

CLASS PISCES

Aquatic craniates with true jaws (Gnathostomes).

SUB-CLASS ELASMOBRANCHII

Gnathostome fishes with cartilaginous skeleton.

Taxonomy and systematic position. — *General treatises.* ★Hasse, J. C. 1879.1; Jaekel, O. 1891.3. — *Review of Japanese forms.* Jordan, D. S. & Fowler, H. W. 1903.5. — *Australian species.* Ogilby, J. D. 1888.1, 1889.2.

Fossil Elasmobranchii. — *Synopsis with geological arrangement.* Agassiz, J. L. 1844.1. — *Chronological distribution.* Hay, O. P. 1901.1. — *Taxonomy of fossil forms.* ★Woodward, A. S. 1889.2. — *For Pre-Linnæan references to fossil Elasmobranch teeth see under Bufonites and Glossopetras in section on Palæontology.*

ORDER PLEUROPTERYGII

From the Palæozoic

Family Cladoselachidæ

Cladoselache. *Morphology and relationships.* ★Dean, B. 1893.2, 1894.1, 1909.5.

Family Cladodontidæ

(Doubtfully admitted here)

Structure and taxonomy. Claypole, E. W. 1893.1, 1895.2, 7; Dollo, L. 1906.1; Traquair, R. H. 1888.3.

ORDER ICHTHYOTOMI

Forms from Upper Palæozoic

Family Pleuracanthidæ

Structure and taxonomy. Davis, J. W. 1893.1; Fürbringer, K. 1904.1; Jaekel, O. 1891.1, 1895.2; ★Reis, O. M. 1897.1, 1914.1; Woodward, A. S. 1893.2.

ORDER ACANTHODEI**Range, Upper Silurian to Lower Permian***Skeleton.* Dean, B. 1907.2; Reis, O. M. 1890.1, 1894.3.*Taxonomy and relationships.* Dames, W. B. 1892.1; ★Dean, B. 1907.2; Dollo, L. 1906.1; Eastman, C. R. 1902.7; Reis, O. M. 1892.2; Woodward, A. S. 1889.2.**Family Acanthodidae***Morphology and classification.* Davis, J. W. 1894.1; Emery, C. 1897.2. — *In Permian of Bohemia.* ★Fritsch, A. J. 1883.1.*Acanthodes.* *Morphology and taxonomy.* Jaekel, O. 1899.3, 1899.4; ★Reis, O. M. 1894.1, 1895.1, 1896.1.**ORDER PLAGIOSTOMI****Including fossil and recent forms***For sharks and rays in fresh-water, see under Physiology.**Relationship to Ganoids.* Baird, S. F. 1871.36.*Fossil forms.* — *Italian specimens.* Liroy, P. 1865.2. — *General popular account.* Woodward, A. S. 1884.1. — *Plagiostome teeth from English Eocene.* Woodward, A. S. 1900.5.*Taxonomy.* — *General treatises.* ★Garman, S. 1913.1; ★Müller, J. & Henle, F. G. 1837.1–1841.1. — *Synoptic table.* Gracianov, V. I. 1907.2. — *Value in classification of number and position of gill slits.* Jaekel, O. 1890.1.*Taxonomy, forms from* — *Indian Archipelago.* Bleeker, P. 1852.11. — *Pacific Ocean.* Miklukho-Maklai, N. N. & Macleay, W. 1879.1. — *Japan.* Pietschmann, V. 1908.3, 5. — *Beaufort, North Carolina.* Radcliffe, L. 1916.1.**SUB-ORDER SELACHII****Sharks***General article, Encyclopedia Britannica.* Günther, A. C. 1911.1; Kerr, J. G. 1911.1.*Geographical distribution.* Engelhardt, R. 1913.1; Simroth, H. R. 1907.2.*Natural history notes, descriptions, etc.* Clarke, S. C. 1877.2, 1880.1; Eichwald, C. E. 1819.1; Gudger, E. W. 1913.1; H., L. 1876.1; ★Hill, R. 1851.1; Moseley, H. N. 1879.1; ★Nichols, J. T. & Murphy, R. C. (*Long Island, N. Y.*) 1916.1; Southwick, J. M. 1885.1; Tatham, W. 1803.1; Anon. 278, 475; Colnett, J. Add. 1798.1. — *Abundance in tropical seas.* Distant, W. L. 1897.1. — *Unusual abundance of dogfish in Scottish waters.* Harvie-Brown, J. A. 1883.1. — *Tenacity of life.* Kemp-Welch, E. B. 1875.1.*Phylogeny and relationships.* Dean, B. 1895.5, 1896.11; Woodward, A. S. 1895.8.*Taxonomy.* — *General accounts.* Bonaparte, C. L. 1838.2; Fowler, H. W. 1908.2; Gill, T. N. 1858.1; Pavesi, P. 1874.1, 1878.1; ★Regan, C. T. 1906.1. — *Selachii admitted as a class.* Agassiz, J. L. R. 1856.7; Gill, T. N. 1909.4; Poche, F. 1902.1, 1911.1.*Taxonomy of sharks from* — *Portugal.**Bocage, J. V. & Capello, F.* 1866.1. — *Eastern North America.* Gill, T. N. 1865.12. — *California.* Gill, T. N. 1863.15. — *Chili.* Philippi, R. A. 1887.2, 1902.1. — *Japan.* Pietschmann, V. 1908.3, 5. — *Collection of Musée Océanographique, Monaco.* Roule, L. 1912.2. — *Greenland.* Jensen, A. S. Add. 1914.1.*Fossil forms.* Braus, H. 1902.1; Woodward, A. S. 1888.16. — *France.* Joleaud, L. 1905.2. — *Silurian of Oesel I., Russia.* Rohon, J. V. 1893.1. — *Carboniferous of Great Britain.* ★Davis, J. W. 1883.1; Traquair, R. H. 1888.3. — *Triassic of Lorraine.* Jaekel, O. 1889.1. — *Jurassic of Normandy.* Bigot, A. 1897.1; Bigot, A. & Brasil, L. 1904.1. — *Jurassic of Württemberg.* Fraas, E. 1896.1. — *Cretaceous.* Kiprijanoff, V. A. (*Russia*) 1852.1; Woodward, A. S. (*British*) 1894.4. — *Tertiary.* Chapman, F. R. & Pritchard, G. B. (*Australia and New Zealand*) 1904.1; Koch, A. (*Hungary*) 1903.1, 1904.2, 1904.3; Pasquale, M. (*Italy*) 1903.1, 1905.2; Winkler, T. C. (*Belgium*) 1874.1, 1878.2. — *Eocene.* Jaekel, O. (*Monte Bolca*) 1894.1; Stromer, E. (*Egypt*) 1905.1. — *Oligocene of Germany.* Jaekel, O. 1898.4. — *Miocene of California.* Jordan, D. S. & Beal, C. H. 1913.1.**Family Notidanidae****Six and seven-gilled Sharks***Taxonomy, — in relation to embryology.* Braus, H. 1906.4. — *of Australian species.* Ogilby, J. D. 1889.2.**Notidanus (Hexanchus, Heptanchus, Heptranchias, syns.).** *Natural history notes, descriptions, etc.* Bellotti, C. 1878.1; Delfortrie, E. 1878.1; Diaz y Martinez, E. 1910.1; Garman, S. 1884.2, 6; Laboissière, V. 1910.1; Macleay, W. 1880.2; Regan, C. T. 1905.10.*Occurrence — on Scottish coast.* Anderson, W. 1894.1; Traquair, R. H. 1896.3. — *on English coast.* Couch, J. 1846.1, 1851.1; Gray, J. E. 1868.2. — *in California waters.* Jordan, D. S. & Gilbert, C. H. 1880.16. — *Hexanchus in Argentina.* Lahille, F. 1913.1. — *in Irish waters.* Scharff, R. F. 1915.2. — *in Gulf of Gascony.* Vaillant, L. L. 1901.1.*Fossil forms, Notidanus, — from Italy.* Bassani, F. 1901.1; Sismonda, E. 1861.1; Lawley, R. (*Pliocene of Tuscany*) 1878.3, 1880.1. — *from Miocene, United States.* Cope, E. D. 1867.1. — *from Aptian Cretaceous of France.* Pictet, F. J. 1865.1. — *in British Jurassic.* Woodward, A. S. 1893.6. — *General account.* Woodward, A. S. 1886.2.**Family Chlamydoselachidae****Chlamydoselachus (Frisled Shark).** *Natural history.* — *Oldest living type of vertebrate.* Cope, E. D. 1883.7, 1884.8; ★Garman, S. 1884.1, 2, 1884.3, 4, 5; Owston, A. 1903.1; Palmén, J. A. 1900.2.*Occurrence — at Funchal, Madeira.* Collett, R. 1890.1. — *in Norway.* ★Collett, R. 1897.4, 1903.2; Grieg, J. A. 1897.3.

— in *Pliocene of Tuscany*. Davis, J. W. 1887.1. — in *Gulf of Gascony*. Pellegrin, J. & Loppé, E. 1914.1.

Taxonomy of Chlamydoselachus anguineus. Davis, J. W. 1885.2; Gill, T. N. Add. 1884.3.

Family Heterodontidæ

(Cestraciodontidæ) Bullhead Sharks

Phylogeny. Eastman, C. R. 1902.6, 7.

Taxonomy — *Australian forms*. De Vis, C. W. 1911.1; Ogilby, J. D. 1889.2. — *Synopsis*. Regan, C. T. 1908.21.

Fossil forms, structure and taxonomy. — *Carboniferous forms*. Davis, J. W. (Great Britain) 1879.2; Lohest, M. (Belgium) 1883.1. — *Tertiary, of France*. Delfortrie, E. 1871.1. — *Cretaceous*. Mackie, S. J. 1863.1; Woodward, A. S. 1891.3.

Heterodontus (Cestracion). *Natural history and relationships*. Elliott, S. 1858.1; Nies, F. 1873.1, 1874.1.

Fossil forms. — *Fossil teeth*. Bryant, H. C. 1914.1; Eastman, C. R. 1911.3. — *H. philippii*, description and relations of fossil species. Strüver, J. K. T. 1864.1.

Hybodus (fossil form from Triassic and Cretaceous). — *Structure and relationships*. Brown, C. 1900.1; Fraas, E. 1889.1, 1896.1; Koken, E. 1907.1; Lomas, J. 1904.1. — *Reconstruction*. Jaekel, O. 1906.2.

Family Cochliodontidæ

Forms from the Palæozoic

Fossil remains and taxonomy. — In *Carboniferous of Belgium*. Leriche, M. 1908.7. — *Structure of mandibular teeth*. Owen, R. 1867.3, 4. — *Taxonomy*. St. John, O. H. & Worthen, A. H. (Revision) 1883.1; Traquair, R. H. 1888.3.

Helodus. — In *Triassic of Alberta*. Lambe, L. M. 1913.2. — *Morphology*. Pander, C. H. 1858.1.

Family Edestidæ

Palæozoic Sharks

Nature and taxonomy. Karpinski, A. P. 1899.1–1916.1; Woodward, A. S. 1899.5.

Edestus. *Literature of Edestus*. Eastman, C. R. 1903.4, 1905.3.

Occurrence in Carboniferous — of *Illinois*. Newberry, J. S. 1888.4; Newberry, J. S. & Worthen, A. H. 1870.1. — of *Britain*. Newton, E. T. 1904.1; Woodward, A. S. 1916.2. — of *Australia*. Woodward, H. 1886.1.

Structure and taxonomy. Davies, W. 1886.1; Dean, B. 1897.3; Eastman, C. R. 1901.3, 1902.7, 1902.8, 1903.4; Fuchs, T. 1900.1; Hay, O. P. 1909.1, 1912.1; Hitchcock, E. H. 1855.1; Hitchcock, F. R. 1887.1; Leidy, J. 1857.5; Missuna, A. 1907.1; Newberry, J. S. 1884.2, 1888.4; St. John, O. H. 1902.1; Trautschold, H. 1883.1, 1886.1, 1888.1; Wiele, C. 1899.1; Woodward, A. S. 1888.5; Cope, E. D. Add. 1886.2.

Helicoprion. *Occurrence in* — *Permian of India*. Koken, E. 1901.1. — *Fusulina-limestone of Japan*. Yabe, H. 1903.1.

Structure of helicoidal organ and relationship of Helicoprion. Eastman, C. R. 1900.4, 1901.3; Fuchs, T. 1900.1; Hay, O. P. 1909.1; Jaekel, O. 1900.1; ★Karpinski, A. P. 1899.1–1916.1; Klaatsch, H. 1901.1; Priem, F. 1900.1; Wiele, C. 1899.1; Woodward, A. S. 1899.5, 1900.3.

Family Psammodontidæ

Carboniferous Sharks

Taxonomy, revision. St. John, O. H. & Worthen, A. H. 1883.1.

Family Petalodontidæ

Carboniferous and Permian

Morphology and relationships. Jaekel, O. 1899.2; Traquair, R. H. 1888.3.

Family Scylliidæ

Dogfishes

Taxonomy. Duméril, A. H. 1853.1, 2.

Ginglymostoma (Nurse Shark). — *Natural history*. Gudger, E. W. 1913.5, Add. 1912.2, 1914.2. For fullest data on the natural history see E. W. Gudger in Copeia, 1921, pp. 57–59.

In *Eocene of Sicily*. Gemmellaro, M. 1912.2.

Pseudotriakis. *Occurrence (only known specimens)* — on coast of Long Island. Bean, T. H. 1884.5; Baird, S. F. Add. 1884.1. — off Portugal. Capello, F. 1868.2, 3.

Sub-family Hemiscylliinae

Taxonomy; Philippine Archipelago. Smith, H. M. 1913.2.

Sub-family Orectolobinae

Nomenclature. Gill, T. N. 1896.12.

Taxonomy; revision. Ogilby, J. D. & McCulloch, A. R. (Australian species) 1908.1; Regan, C. T. 1908.19.

Sub-family Scylliorhinae

Taxonomy; synopsis. Regan, C. T. 1908.22.

Family Carchariidæ

Carcharias. *Fossil species from* — *Pliocene of Spain*. Binney, E. W. 1879.1. — *Red Crag of Suffolk*. Charlesworth, E. 1837.1. — *South Carolina*. Manigault, G. E. 1886.1.

Galeocerdo (Tiger Shark). — *Comparison, living and fossil forms*. Lawley, R. 1881.1.

Fossil species from — *Miocene; United States*. Cope, E. D. 1867.1. — *Piedmont, Italy*. Sismonda, E. 1861.1. — *English Chalk*. Woodward, A. S. 1894.2.

Mustelus. *Differences between the two European forms*. Pietschmann, V. 1908.4.

Prionodon. *Taxonomy; general account*. Carruccio, A. 1912.2.

Thalassorhinus. *Original description*. Walbaum, J. J. 1784.2.

Family Lamnidae

Mackerel Sharks

Fossil teeth in — *Italian Tertiary deposits*. Oppenheim, P. 1901.1. — *Eocene of Rumania*. Popovici-Hatzeg, V. 1896.1. — *Eocene of Egypt*. Quaas, A. 1902.1.

Alopias (Alopecias) (*Thresher or Fox Shark*). *Natural history, occurrence, etc.* Clogg, S. 1881.1; Couch, R. Q. 1864.4; Gatcombe, J. 1882.1, Add. 1885.2; Grieg, J. A. 1902.1; Johnston, G. 1849.1; Mitchill, S. L. 1805.2; Parona, C. 1883.1; Pascoe, F. P. Add. 1881.1; Southwell, E. Add. 1906.1.

Carcharodon (*Man-eater*). — *Occurrence* — in *Italian and Sicilian waters*. Facciola, L. 1894.1; Riggio, G. 1894.1; Sanzo, L. 1910.1. — *off coast of California*. Holder, C. F. 1900.2. — *Nantucket, Mass.* Stevenson, W. G. 1884.1.

Fossil forms — *from Italy*. Bassani, F. 1877.1, 1886.3, 1895.2. — *in Cretaceous of California*. Blake, J. H. 1873.1. — *in Pliocene of Belgium*. Dewalque, G. 1864.1, 1871.1. — *in Spitzbergen*. Hanse-mann, D. 1910.1. — *in Oligocene of Panama*. Joukowsky, E. 1906.1. — *in South Carolina*. Manigault, G. E. 1886.1. — *in Tertiary of Chile*. Möricke, W. 1895.1; Philippi, R. A. 1878.1. — *in Oligocene of Helmstedt*. Nehring, A. 1878.1.

Restoration of jaws of C. megalodon. Dean, B. 1909.1; Hussakof, L. 1912.2.

Lamna (*Porbeagle*). *Natural history notes*. Goodenough, S. 1797.1; Mayer, A. F. 1842.2; Weber, M. C. 1892.1; Clément, C. Add. 1876.1.

Occurrence — *on English coast*. Bowerbank, J. S. 1873.2, 1874.1; Gatcombe, J. 1881.1; Kermode, P. M. 1897.2; Thompson, W. 1850.2. — *off Scottish coast*. Campbell, J. M. 1880.1; Evans, W. 1905.1; Taylor, W. 1910.1. — *on coast of Friesland*. Ehlers, E. H. 1886.1. — *in New Zealand*. Haast, J. F. 1875.1. — *in Irish waters*. Warren, R. 1900.2. — *in Dublin Bay*. Duerden, J. E. Add. 1894.1.

Mitsukurina (*Scapanorhynchus*). *Natural history, including descriptions, occurrence in Japanese waters, taxonomy, etc.* Bean, B. A. 1905.3; Dean, B. 1903.1; Engelhardt, R. 1912.1; Hussakof, L. 1909.1, 1910.3; Jordan, D. S. 1898.2; Stehli, G. 1912.2; Vaillant, L. L. 1904.4; Woodward, A. S. 1899.3.

Odontaspis. *Occurrence at Sardinia*. Carruccio, A. 1910.1.

Oxyrhina. — *General treatise*. ★Eastman, C. R. 1894.1. — *O. hastalis, in Miocene of Italy*. Alessandri, G. 1896.1.

Family Cetorhinidae

Cetorhinus (*Selache*) (*Basking Shark*). *Natural history*. Baird, S. F. 1868.1, 1874.2; Giglioli, E. H. 1877.1; Gunner, J. E. (*Original description*) 1767.1; Lehmann, M. C. 1803.1; Vieira, L. 1894.4; Wright, E. P. 1876.1.

Occurrence in western Atlantic — in

Bay of Fundy: Foulis, R. 1852.1. — *off Newfoundland*. Harvey, M. 1877.1, 1880.1. — *off Long I., N. Y.* Hussakof, L. 1915.1.

Occurrence on Scandinavian and Iceland coasts. — *Norwegian waters*. Collett, R. 1903.2; Grieg, J. A. 1897.1; Friis, N. C. Add. 1772.1, Add. 1776.1. — *Iceland*. Lütken, C. F. 1879.1, 1880.2; Sæmundsson, B. 1897.1.

Occurrence on British coast. — *Cornwall*. Cornish, T. 1870.4, 1885.1; Gatcombe, J. Add. 1885.1. — *Scotland*. Elmhirst, R. 1913.1; Murie, J. Add. 1906.1. — *Isle of Wight*. Hadfield, H. 1875.1. — *Torquay harbour*. Pengelly, W. 1891.1. — *in Irish waters*. Scharff, R. F. 1915.2.

Occurrence off Spain and Portugal. Capello, F. 1870.4; Escribano, C. 1909.1.

Occurrence on Italian coast. Carazzi, D. 1904.3; Carruccio, A. 1906.1, 1907.1; Damiani, G. 1903.1; Mazzarelli, G. F. 1908.2; Monti, R. 1910.1; Parisi, B. 1912.1; Parona, C. 1908.1; Pavesi, P. 1874.1, 1877.1; Senna, A. 1913.1.

Occurrence in the Pacific. Bennett, F. D. 1840.1; Wilson, E. R. 1877.1. — *in Australian and New Zealand waters*. Cheeseman, T. F. 1891.1; Kershaw, J. A. 1902.1; Beneden, P. J. Add. 1893.1; Macleay, W. J. Add. 1884.1. — *For a general account of Cetorhinus in the southern Hemisphere, see E. W. Gudger in Science, 1915, n.s. vol. 42, pp. 653-656.*

Taxonomy and synonymy. Blainville, H. M. 1810.1; Couch, J. 1864.2; Pavesi, P. 1874.1.

Fossil forms. — *in Pliocene of Belgium*. Hasse, J. C. 1879.1. — *in Pliocene of Ricava, Tuscany*. Lawley, R. 1880.2. — *in Miocene of San Marino Republic*. Lawley, R. 1882.1.

Family Rhinodontidae

Rhineodon (*Whale Shark*). — *Natural history*. ★Bean, B. A. 1905.2. — *Discovery* — *first description, anatomy, earliest figure, etc.* Smith, A. 1829.1, 1849.1.

For a paper reviewing previous literature on habits, anatomy, etc., with reproductions of every known figure, and a collection of records of occurrence, see Gudger, E. W. 1915.1. For "Further notes on habits and distribution," see his article in Science, 1918, n.s. vol. 48, pp. 622-627.

Family Spinacidae

Spiny Sharks

Taxonomy in relation to embryology. Braus, H. 1906.4.

Centrina. *Natural history*. Künstler, J. & Chaine, J. 1906.2.

Centrophorus. *Natural history notes*. Jensen, A. S. 1899.1; Bocage, J. V. Add. 1872.1.

Occurrence — *off Madeira Islands*. Lowe, R. T. 1852.1. — *in Irish waters*. Scharff, R. F. 1915.2. — *in British waters*. Sim, G. 1902.2.

Echinorhinus. *Occurrence* — *on coast*

of Cornwall. Cornish, T. 1866.4, 1870.7, 1875.2, 1882.3. — on British coast. Gray, J. E. 1868.2. — on Dublin coast. More, A. G. 1882.1. — at Venice. Ninni, E. 1904.2. — in New Zealand waters. Parker, T. J. 1884.4.

Læmargus (Somniosus) (Sleeper Shark, Greenland Shark). Natural history notes, descriptions, etc. Gunner, J. E. (Earliest description) 1766.3; Levander, K. M. 1898.1; Möbius, K. A. 1890.1; Rosted, E. 1788.1; Trail, J. 1872.1; Valenciennes, A. 1832.1.

Occurrence — on coast of Netherlands. Beaufort, L. F. 1911.1. — on coast of Scotland. Brown, R. 1860.1. — on Dogger Bank. Cordeaux, J. 1866.1. — in Danish waters. Fiedler, H. V. 1866.1. — on coast of Italy. Sicher, E. 1898.1. — off Suffolk coast. Southwell, T. 1875.1. — in lower St. Lawrence. Dawson, J. W. Add. 1891.1.

Scymnus. Nomenclature. Gill, T. N. 1896.14.

Family Squalidæ

Taxonomy. — Chile. Pérez, C. C. 1886.1. — Philippines. Smith, H. M. 1912.6. — Synopsis. Regan, C. T. 1908.23.

Fossil forms. — Monograph, fossil forms of United States. Gibbes, R. W. 1847.1, 1848.2. — Miocene of California. Leriche, M. 1908.4. — Eocene of Egypt. Stromer, E. 1905.1.

Family Pristiophoridæ

Systematic position and fossil remains. Jaekel, O. Add. 1890.3.

SUB-ORDER BATOIDEI

Rays

Natural history notes, popular articles, etc. Clarke, S. C. 1880.3; Fowler, H. W. 1910.6; Müller, J. 1839.3; Roberts, A. W. 1880.1; Schneider, J. G. 1788.1.

Taxonomy and relationships. Jaekel, O. 1898.1. — Indian forms. Annandale, N. 1909.1, 1910.1. — Relationship with sharks. Hasse, J. C. 1877.2.

Family Pristidæ

Fossil forms from Eocene of Egypt. Stromer, E. 1905.1.

Pristis (Saw-fish). — Natural history data. Caton, J. D. 1879.1; Guettard, J. E. 1768.1; Latham, J. (First scientific description) 1794.1; Pappenheim, P. 1905.1; Rawlinson, T. E. 1858.1; Southwell, T. 1902.3; Perrault, C. Pre-Linn. 1733.1. — Taxonomy, synopsis of fossil species. Vigliarolo, G. 1891.1.

Propristis. Occurrence — in Eocene of Egypt. Fraas, E. 1907.1. — in lower Tertiary of Egypt. Priem, F. 1897.1.

Family Rhinobatidæ

Guitar fishes

Taxonomy; synopsis American species. Garman, S. 1880.1.

Family Rajidæ

Skates and Rays

Taxonomy. Delfin, F. T. 1902.2; Garman, S. (United States) 1875.1; Jaekel, O. 1898.1. — From Eocene of Monte Bolca. Molin, R. 1861.1.

Raia. Natural history accounts, descriptions, etc. Batarra, G. 1765.1; Beneden, E. 1894.1; Borcèa, J. 1907.2,3; Giorna, M. E. 1805.1; Harting, P. 1867.4; Schneider, J. G. 1783.2; Calderwood, W. L. Add. 1892.1; Günther, A. C. (Encyc. article) Add. 1866.1; Columna, F. Pre-Linn. 1592.1.

Genera Hieroptera and Propterygia. Originally described as specific forms, these are now known to be rays with arrested development of the pectorals (these non-adherent to the head). For such see under Abnormalities of Fins, in section on Teratology.

Family Torpedinidæ

Electric Rays

For anatomy and function of electrical organs, see under Electrical Fishes.

General treatise. Duméril, A. H. 1852.1. — Synonymy. Gill, T. N. 1896.15. — Natural history. Kammerer, P. 1906.1.

Genus Torpedo. — Natural history. Basarow, A. 1877.1; Bonaparte, C. L. 1840.2; Bouvier, E. L. 1890.2; Bryant, W. 1786.1; Colladon, L. T. 1836.1; ★Fulton, T. W. 1901.1; Grisellini, F. 1764.1; Harting, P. 1880.2; Le Juge, E. 1876.1; Linck, J. W. 1788.1; Lucchesini, — 1783.1; Montelimart, D. F. 1799.1; ★Olfers, I. F. 1831.1; Poche, F. 1907.2; Langguth, G. A. Add. 1779.1; Schilling, G. W. Add. 1770.1. — Fossil form, *Torpedo hilgendorfi*, in Tertiary of Kamerun. Jaekel, O. 1904.3.

Family Trygonidæ (Dasyatidæ)

"Stingarees" or Sting Rays

Dasybatus. — Taxonomy. Synopsis, American species. Garman, S. 1882.1. — Nomenclature. Garman, S. 1885.3.

Family Myliobatidæ

Eagle Rays

Nomenclature. Gill, T. N. 1895.5.

Fossil forms — in Sicily. Salinas, E. 1901.1. — in Eocene of Bavaria. Stromer, E. 1904.2. — in Eocene of Egypt. Stromer, E. 1905.1.

Aëtobatus (Spotted Sting Ray). — Nomenclature. Gill, T. N. 1895.5. — Fossil forms. Castro, M. F. (Tertiary, Cuba) 1873.1; Cope, E. D. (Miocene, United States) 1867.1; Sloane, H. (Maryland) Pre-Linn. 1697.1.

For a paper reviewing all previous literature on habits, coloration, external structures, distribution, reproduction, with many illustrations original and reproduced, and with a full synonymy, see Gudger, E. W. 1914.1.

Dicerobatis. Natural history, occurrence, etc., — in Jamaica. Hill, R. 1863.1.

— on coast of Natal. Millar, A. D. 1899.1.
— in Oran. Pellegrin, J. 1901.6. — in the Mediterranean. Pellegrin, J. 1902.3. — at Funchal, Madeira. Vinciguerra, D. 1883.1.

Ceratoptera. Occurrence and natural history — at Port Royal, Jamaica. Lamont, A. 1824.1.

Cephaloptera. Natural history. Heeckeren Tot Waliën, L. 1897.1; Vorderman, A. G. 1897.1.

Occurrence — in Jamaica. Bancroft, E. N. 1829.1. — at Malta. Gulia, Giovanni. 1909.3. — in the Mediterranean. Pellegrin, J. 1902.3. — in Irish waters. Thompson, W. 1835.1, 1837.1. — in Straits of Messina. Facciola, L. Add. 1903.1. — at Cetta. Ribart. Add. 1759.1.

Manta (Devil fish). Natural history. ★Elliott, W. 1846.1–1867.1; ★Gill, T. N. 1908.5; H., C. F. 1874.2; Holder, C. F. 1899.1; Holder, J. B. 1871.1; Holmes, F. S. 1856.1; Lesueur, C. A. 1824.1; Mitchill, S. L. 1824.1; Pellegrin, J. 1900.8; Anon. 308, 309.

Occurrence — on coast of Peru. Baer, G. A. 1899.1; Vaillant, L. L. 1899.2. — on California coast. Diguët, L. 1898.1; Kahilainen, W. 1899.3; Oustalet, E. 1899.1; Pellegrin, J. 1901.5, 6; Vaillant, L. L. & Diguët, L. 1898.1; Newman, E. Add. 1849.1. — on New Jersey coast. Fowler, H. W. 1903.8. — in Mediterranean. Pellegrin, J. 1902.3. — in North Carolina. Gill, T. N. Add. 1903.2.

Myliobatis (Eagle Ray). Natural history. Johnston, G. 1834.3; Cunningham, J. T. Add. 1895.3; Holt, E. W. & Garstang, W. Add. 1898.1.

Fossil forms. Taxonomy and occurrence. Gibbes, R. W. 1847.2; Marsh, O. C. 1870.1; Owen, R. 1847.1; Philippi, R. A. 1846.1. — In Eocene. Delheid, E. (Belgium) 1896.2; Popovici-Hatzeg, V. (Rumania) 1896.1; Woodward, A. S. (England) 1888.9. — In Tertiary. Kissling, E. (Switzerland) 1902.2; Meyer, C. E. H. (Germany) 1851.2; Woodward, A. S. (Egypt) 1893.8. — Cretaceous, Tunis. Sauvage, H. E. 1889.2.

Mobula (Small Devil-fish). Natural history and occurrence — off the North Carolina coast. Boulenger, G. A. 1912.9; Pellegrin, J. 1912.4. — in Japanese waters. Kampen, P. N. 1910.1.

Ptychodus. Dentition. Canestrelli, G. 1910.1; Woodward, A. S. 1887.6.

ORDER HOLOCEPHALI

Taxonomy of fossil forms. ★Woodward, A. S. 1889.2.

Family Ptyctodontidae

Devonian forms

Arthrodiran affinities. Dollo, L. 1907.2. — Dentition. Eastman, C. R. 1898.2, 1904.8.

Ptyctodus. Morphology (particularly dentition) and relationships. Pander, C. H. 1858.1; Rohon, J. V. 1895.1.

Family Squaloraidae

Lias

Squaloraia. Structure and affinities. Howes, G. B. 1890.1; Weyl, T. 1884.1; Woodward, A. S. 1886.1.

Family Myriacanthidae

Lias

Taxonomy. Woodward, A. S. 1889.9.

Family Chimæridae

Including fossil and recent forms

General treatises, recent forms. — Chimæroid fishes and their development. ★Dean, B. 1906.1. — Origin of Chimæridæ. Regan, C. T. 1912.14.

Taxonomy of recent forms. Bean, B. A. & Weed, A. C. 1910.1; ★Garman, S. 1901.1, 1904.1, 1911.1. — in Irish waters. Holt, E. W. L. & Byrne, L. W. 1910.3. — in Philippines. Smith, H. M. 1912.2.

Fossil forms, structure and taxonomy. General accounts. — Taxonomy. Egerton, P. G. 1843.2, 1846.1, 1847.2; Riess, J. A. 1887.1.

Occurrence of fossil forms — in Jurassic of Württemberg. Fraas, E. 1896.1. — in Jurassic of Prussia. Meyer, C. E. H. 1859.3. — in American Cretaceous. Hussakof, L. 1912.1. — in British Cretaceous. Newton, E. T. 1878.1, 1880.1, Add. 1878.1. — in Cretaceous of New Zealand. Newton, E. T. 1877.1.

Callorhynchus. Earliest known figure. Frézier, A. F. Pre-Linn. 1716.1.

Chimæra. Natural history accounts. Baird, S. F. 1877.2; Dean, B. 1904.6; Gunner, J. E. 1766.7; L., W. N. 1879.1; Holt, E. W. Add. 1893.1.

Occurrence — at Nice. Deakin, R. 1866.1. — in North Sea. Cordeaux, J. Add. 1898.1. — in California waters. Serre, P. 1901.1.

Phylogeny and relationships. Dean, B. 1899.5, 1905.3.

Taxonomy. — Philippine species. Smith, H. M. 1912.2. — Japanese species. Tanaka, S. 1905.1, 2. — Cuban species. Poey y Aloy, F. 1865.1.

Fossil forms — in Cretaceous of England. Buckland, W. 1836.1. — in Jurassic of Bavaria. Meyer, C. E. 1863.1. — Synopsis of fossil species. Egerton, P. G. 1843.2.

Harriotta. Natural history. Dean, B. 1904.8; Mitsukuri, K. 1905.1.

SUB-CLASS TELEOSTOMI

Gnathostome fishes with bony skeleton.

Phylogeny. Regan, C. T. 1904.9.

Fossil forms. — Of Florissant (Colorado) shales. Cockerell, T. D. 1906.1, 1908.2. — Eocene of Wyoming. Cope, E. D. 1873.3. — Taxonomy of fossil forms. Woodward, A. S. 1889.2.

SERIES GANOIDEI

(Formerly a sub-class)

This group name is retained here for convenience, as it has been in other parts of the Subject Index, and under it are included various fossil orders, families, and genera, and the

recent orders Crossopterygii, Chondrostei, and Holostei with their genera.

Phylogeny and relationships. — *General treatises.* ★Müller, J. 1844.2, 1845.1, 1846.1, 2; Orr, H. 1885.1. — *Relation to Plagiostomes.* Baird, S. F. 1871.36. — *Relations with Teleosts.* Huxley, T. H. 1883.2. — *Relation to Clupeidæ.* Stannius, F. H. 1846.1. — *Affinities in general.* Dean, B. 1895.6, 7; Zograf, N. Y. 1887.4.

Taxonomy, general accounts. Agassiz, J. L. R. 1856.9; Baird, S. F. 1871.28; Fowler, H. W. 1910.7; Hollard, H. L. 1850.1; Kner, R. 1866.1; ★Lütken, C. F. 1868.1, 1869.1, 2, 1871.1, 1873.1, 4; Vogt, C. C. 1845.1.

Fossil forms. General papers. — *Synopsis of fossil forms.* Agassiz, J. L. 1833.3, 1835.1. — *Geological history.* Bachmann, I. 1877.1. — *Ganoidei heterocerci.* Egerton, P. G. 1848.3 (3). — *Palæontology.* Martin, Carl. 1873.1. — *Devonian forms.* Pander, C. H. 1860.1. — *On the genera of Agassiz.* Traquair, R. H. 1877.3. — *Charts illustrative of.* Zittel, K. A. 1900.1.

Occurrence of fossil forms in — *Illinois, Ohio and Pennsylvania.* Cope, E. D. 1897.2. — *Fayum, Egypt.* Dames, W. B. 1883.1. — *Trias of Germany.* Dames, W. B. 1888.2; Deecke, J. E. 1889.1. — *Carboniferous, England.* Davis, J. W. 1871.1; Miall, L. C. 1872.1, 1879.1. — *Deccan, India.* Egerton, P. M. 1878.1. — *Trias of Connecticut Valley.* Lull, R. S. 1912.1, 1915.1. — *Carboniferous of France.* Sauvage, H. E. 1889.1. — *Silurian of Oesel I., Russia.* Rohon, J. V. 1893.1. — *Eocene of Egypt.* Stromer, E. 1905.1. — *Lithographic limestone, Munich Museum.* Vetter, B. 1881.1. — *Jurassic of Bavaria.* Wagner, J. A. 1863.1. — *English Lias.* Woodward, A. S. 1890.5. — *English Greensand; synopsis.* 1895.9.

ORDER CROSSOPTERYGII

Fossil and recent

Recent Crossopterygii. — *Revision; African species.* Boulenger, G. A. Add. 1909.1.

Structure and relationships of fossil forms. Cope, E. D. 1891.3, 4; Huxley, T. H. 1866.1; Miall, L. C. 1878.1; Pander, C. H. 1860.1; Watson, D. M. & Day, H. 1916.1. ★Woodward, A. S. 1889.2.

SUB-ORDER OSTEOLEPIDA

Devonian and Carboniferous forms, one family, Cœlacanthidæ, persisting into the Cretaceous.

Family Osteolepidæ

Megalichthys. *Structure and systematic position.* Watson, D. M. 1912.1; Wellburn, E. D. 1900.3.

Family Rhizodontidæ

Eusthenopteron. — *For a recent summary of our knowledge of Eusthenopteron, see* ★W. L. Bryant, in Bull. Buffalo Soc. Nat. Sci., 1919, vol. 13, pp. 1-22, 18 pls.

Family Holoptychidæ

Dendrodontidæ, synonym

Structure. — *Dentition.* Jaekel, O. 1894.3; Pander, C. H. 1860.1. — *Forms in Russian Devonian.* Rohon, J. V. 1889.1. — *Scales in Russia.* Rohon, J. V. 1892.1. *Systematic position.* Traquair, R. H. 1889.4; Trautschold, H. 1889.2.

Family Cœlacanthidæ

Structure and taxonomy. ★Reis, O. M. 1888.1. — *Osteology.* 1892.3. — *Restoration of Cœlacanthus.* Wellburn, E. D. 1902.2.

SUB-ORDER CLADISTIA

Family Polypteridæ

No fossil forms

For maps showing the distribution of the Polypteridæ, see Bridge, T. W. 1904.1 (p. 483), and Meek, A. 1916.1 (p. 57).

Calamoichthys. *Natural history.* Gervais, F. L. 1867.1; Smith, John A. 1867.1, 2, 11.

Polypterus. *Natural history.* Budgett, J. S. 1900.1, 3, 1907.1; Dean, B. 1899.2; Geoffroy-Saint-Hilaire, E. F. 1802.2, 3; Harrington, N. R. 1899.1, 2.

Taxonomy, phylogenetic position, etc. Ayres, W. O. 1850.2; Boulenger, G. A. 1898.13, 1911.5; Duméril, A. H. A. 1869.1; Goodrich, E. S. 1908.2; Guichenot, A. 1839.1; Pollard, H. B. 1891.1, 1892.2; Steindachner, F. 1869.1, 2. — *Diagnostic key to young.* Boulenger, G. A. 1902.27. — *Differences between the three Nile species.* Steindachner, F. 1882.2.

ORDER CHONDROSTEI

(Acipenseroides, or cartilaginous Ganoids)

For a map showing the geographical distribution of the recent Chondrostei, see Meek, A. 1916.1 (p. 50).

Structure, taxonomy and affinities of both recent and fossil forms. Heckel, J. J. 1851.5; Woodward, A. S. 1889.2; Zograf, N. Y. 1887.4.

Palæontology, Acipenseroides. Woodward, A. S. 1889.10.

Family Cheirolepidæ

Devonian

Morphology. Pander, C. H. 1860.1.

Family Palæoniscidæ

Devonian to Jurassic

Occurrence, structure and taxonomy of forms from — *Permian of Bohemia.* Fritsch, A. J. 1883.1. — *Carboniferous of New Brunswick.* Lambe, L. M. 1910.1. — *Trias of British Isles.* Lomas, J. 1904.1. — *Carboniferous of France.* Sauvage, H. E. 1888.3. — *British Carboniferous.* ★Traquair, R. H. 1877.1, 1886.1, 1888.2, 1901.1, 1907.1, 1909.1, 1911.1, 1912.1. — *Ecca shales.* Woodward, A. S. 1910.1.

Family Platysomidæ

Carboniferous and Permian

Structure and affinities. Cope, E. D. 1880.4; Gill, T. N. 1881.3; ★Traquair, R. H. 1879.3, Add. 1880.2.

Family Belonorhynchidae

Triassic forms, doubtfully Chondrosteian

Osteology and taxonomy. Reis, O. M. 1892.4.**Family Catopteridae**

Triassic forms

Taxonomy. Eastman, C. R. 1914.1; Silliman, B. 1821.1.**Family Chondrosteidae**

English Lias

Structure and taxonomy. Woodward, A. S. 1889.2.**Family Polyodontidae****Crossophilis.** *Fossil paddlefish from Eocene of Wyoming.* Cope, E. D. 1883.3, 1885.1, 1886.2.**Polyodon folium (spathula)** (*Spoon-bill or Paddlefish*). *Natural history and occurrence in Mississippi R. and tributaries.* Allen, W. F. 1911.1; Beach, H. 1902.1; Beard, D. C. 1878.1; Cabot, S. 1848.2; Clemens, J. W. 1827.1; Hildreth, S. P. 1827.1; ★Hussakof, L. 1910.5, 1911.3; Kofoid, C. A. 1900.1; Lacépède, B. G. (*First description*) 1797.1; Mitchill, S., Hildreth, S. & Clemens, J. W. 1822.1; Nichols, J. T. 1916.2; Polk, B. H. 1879.1; Silliman, B. 1827.1; ★Stockard, C. R. 1907.5; Travell, W. 1914.1; Alexander, M. L. Add. 1914.1.**Psephurus gladius (Polyodon (angustifolium) gladius)** *from China.* *Structure and classification.* Duméril, A. H. A. (*Fine figures*) 1868.1; Handyside, P. D. 1875.1; Kaup, J. J. 1862.1; Martens, E. (*Discoverer*) 1862.1.**Family Acipenseridae**

Sturgeons

Taxonomy. Berg, L. S. 1904.1; ★Duméril, A. H. 1867.2, 1868.1. — *European-Asiatic forms.* Brandt, J. F. 1869.1. — *Russian species.* Golowatschow, A. 1857.1; Lovetsky, A. 1834.1. — *European forms.* Heckel, J. J. 1851.3. — *Synopsis; Japanese forms.* Jordan, D. S. & Snyder, J. O. 1906.4. — *Caucasian forms, including those from Caspian and Black Seas.* ★Kavraiskii, T. T. 1907.1; Sodoffsky, W. 1849.1. — *Review; North American forms.* Kirsch, P. H. & Fordice, M. W. 1890.1. — *Italian forms.* Maglio, C. 1901.1; Nardo, G. D. 1873.2; Pavesi, P. 1907.1. *Fossil forms from Eocene of Paris basin.* Priem, F. 1904.3.**Acipenser** (*Sturgeon*). *General treatises.* Brusina, S. (*Text in Bohemian*) 1902.1; Heckel, J. J. & Fitzinger, L. J. 1836.1.*Natural history notes.* — *Text in English.* Baker, W. 1847.1; Evermann, B. W. 1898.4; Fulton, T. W. 1903.2; Sweetapple, E. 1867.2; White, J. H. 1873.1. — *Text in French.* Duchaussay, H. 1891.1; Roule, L. 1905.3. — *Text in German.* Berg, P. J. 1776.1; ★Ehrenbaum, E. 1896.1, Add. 1913.3; Grimm, O. 1895.1; Kornhuber, G. A. 1901.2, 3, 4; Pallas, P. S. 1776.1; Bergius, B. & Marwitz,Add. 1776.1; Brandt, J. F. & Ratzeburg, J. T. Add. 1831.1. — *Text in Russian.* Borodin, N. A. 1897.1, 1901.2; Grünberg, V. 1905.1; ★Peltzam, E. D. 1883.1. — *Text in Finnish, Bohemian, Swedish, and Polish, respectively.* Kahilainen, W. 1899.1; Katuric, M. 1903.1; Nordqvist, O. F. 1899.1, 3; Schalin, Z. 1883.1; Rozwadowski, J. 1906.1, 2.*A. ruthenus, variation.* Mojsisovics von Mojsvar, A. 1892.1.*Fossil forms — in Cretaceous of Canada.* Lambe, L. M. 1902.1; Osborn, H. F. 1902.1. — *from Palaeozoic.* Zittel, K. A. 1886.2.**Scaphirhynchus** (*Shovel-nosed Sturgeon*). *Taxonomy.* Pappenheim, P. 1905.4; Westberg, P. 1899.1.*American form, occurrence and taxonomy — in Ohio R.* Agassiz, J. L. 1846.2; Heckel, J. J. 1836.2; Gill, T. N. Add. 1863.1.*Asiatic (Turkestan) form of Scaphirhynchus (Pseudoscaphirhynchus and Kessleria, synonyms), natural history, occurrence and taxonomy.* Baer, K. E. 1874.1; Baird, S. F. 1873.29; Grevé, C. H. 1896.1; Günther, A. C. 1873.5; Kessler, K. T. (*first account*) 1873.2, 1874.1; Nikolskii, A. M. 1900.2.**Parascaphirhynchus.** *P. albus* described from nine specimens taken in Mississippi R. Forbes, S. A. & Richardson, R. E. 1905.1.**ORDER HOLOSTEI**

(Lepidosteidae, or bony Ganoids)

*For a map showing the distribution of the recent Holostei, see Meek, A. 1916.1 (p. 53).***Family Semionotidae**

Permian to Cretaceous inclusive

Occurrence and taxonomy. — *Triassic, Connecticut R. Valley.* Lull, R. S. 1915.1. Silliman, B. 1821.1. — *General account.* Woodward, A. S. 1895.3.**Dapedius.** *Taxonomic revision.* Browne, A. M. 1890.1.**Lepidotus.** *Morphology and taxonomy.* ★Branco, C. W. 1885.1, 1887.1, 1890.1; Priem, F. 1908.2.**Semionotus.** *Structure and classification.* Schellwien, E. T. 1902.1.**Family Pycnodontidae**

Lower Lias through Lower Eocene

General treatise. ★Hennig, E. 1906.1, 1907.2.*Taxonomy and occurrence.* Egerton, P. G. 1877.1; Heckel, J. J. 1854.4, 1855.1; Hermann, R. 1907.1; Woodward, A. S. 1893.10. — *In France.* Cornuel, J. (*Paris Basin, Jurassic*) 1880.1, 1883.1; Leriche, M. 1901.2; Priem, F. (*Tertiary*) 1902.1. — *In Jurassic of Switzerland.* Jaccard, S. A. 1888.1. — *In lithographic limestone of Bavaria.* ★Wagner, J. A. 1863.1.**Gyrodus.** *Morphology; monographic treatment.* Hennig, E. 1906.1.

Family Eugnathidæ

Triassic and Jurassic

Structure and taxonomy. Woodward, A. S. 1889.2.**Caturus and Osteorachis.** *Osteology.* Woodward, A. S. 1897.2.**Family Amiidæ Camiatidæ**

Range, Eocene to present

Taxonomy. Hay, O. P. 1898.1.**Amia** (*Bow-fin, Grindley*). *Natural history, occurrence, etc.* Bean, T. H. 1890.17; Eyrich, G. C. 1877.1; Desrochers, J. E. 1904.1; Debschitz, H. 1901.2, 5; ★Reighard, J. 1904.2; Robinson, W. E. 1875.1. — *In Susquehanna R.* Stauffer, J. 1879.1. — *Nomenclature, general discussion.* Heckel, J. J. 1851.5.*Fossil species — in Miocene of Germany.* Andreae, A. 1893.1, 1894.1. — *in Tertiary.* Giebel, C. G. (*France*) 1869.1; Marsh, O. C. (*Wyoming*) 1871.1. — *in Oligocene.* Lambe, L. M. (*Saskatchewan*) 1908.1; Leriche, M. (*Isle of Wight*) 1908.6; Newton, E. T. (*Isle of Wight*) 1899.1. — *in Eocene of Suffolk.* Leriche, M. 1907.5.**Amiopsis**, from — *Black Hills of South Dakota.* Eastman, C. R. 1900.3. — *Cretaceous of Croatia.* Kner, R. 1863.3.**Family Pachycormidæ**

Lias through Cretaceous

Taxonomy. — *Of forms from Jurassic of France.* Sauvage, H. E. 1898.1. — *Characteristics of the genera.* Wagner, J. A. 1860.5.**Protosphyraena (Erisichthe).** — *Structure, taxonomy and affinities.* Cope, E. D. (*General account*) 1877.5; Felix, J. P. 1890.1; Hay, O. P. 1902.3, 1903.2; Quaas, A. 1902.1; Steward, A. S. 1898.1; Woodward, A. S. 1894.7.*Occurrence in Cretaceous.* — *Kansas Niobrara.* Cope, E. D. 1872.5. — *Italy.* Mariani, E. 1902.1. — *Lincolnshire.* Woodward, A. S. 1912.3. — *Belgium.* Dollo, L. Add. 1893.1.**Family Aspidorhynchidæ**

Upper Jurassic and Cretaceous

Evolution. Woodward, A. S. 1890.12.**Aspidorhynchus.** *Structure and relationships.* Assmann, P. 1906.1. — *Relation to Lepidosteus.* Reis, O. M. Add. 1888.1.**Family Lepidosteidæ***Classification.* Hay, O. P. 1898.1. — *In Keuper of Upper Silesia.* Michael, R. 1894.1.**Lepidosteus** (*Gar-pike*). *Natural history, including distribution.* Coffin, C. E. 1874.1; Cope, E. D. 1865.3, 1870.4; Dunbar, G. P. 1882.1; K., S. 1877.1. — *Occurrence in prehistoric times (Stone Age).* Abbott, C. C. 1872.3.*Relationships.* — *Relationship of Lepidosteus to Aspidorhynchus and Belonostomus.* Reis, M. Add. 1888.1. — *Lepidosteus sinensis; present status.* Wagner, G. 1912.1.*Fossil forms.* Agassiz, J. L. 1848.3, 1850.7. — *In Miocene of Germany.* Andreae, A. 1893.1, 1894.1. — *In Oligocene of Saskatchewan.* Lambe, L. M. 1908.1. — *In Tertiary of Wyoming.* Marsh, O. C. 1871.1. — *In Cretaceous.* Osborn, H. F. 1902.1. — *In Eocene of N. America.* Cockerell, T. D. (*Utah*) 1909.1; Cope, E. D. (*Wyoming and New Mexico*) 1883.1; Eastman, C. R. (*Wyoming*) 1900.2, 5. — *In Eocene of France.* Dollo, L. 1893.3, Add. 1890.1; Gervais, F. L. (*Paris Basin*) 1874.2; Harting, P. (*Paris Basin*) 1875.6; Malaquin, A. G. 1900.1; Anon. 536.**SUB-CLASS DIPNOI**

(Dipneusti) Lung-fishes

For maps showing the distribution of the recent Dipnoi, see Bridge, T. W. 1904.1 (p. 512), and Meek, A. 1916.1 (p. 57).*Natural history accounts.* Bolau, C. C. 1901.1, 1910.1; Brandes, G. 1893.1; Dybowski, W. 1878.1; Perret, A. 1900.1; Anon. 348, 349, 350.*Structure and relationships of both recent and fossil forms.* ★Ayers, H. 1885.1, 1893.2; ★Dollo, L. 1896.2; Miall, L. C. 1878.1; Watson, D. M. & Day, H. 1916.1. — *Affinities with extinct fishes.* Crane, A. 1877.1. — *Relation to Arthrodira.* Eastman, C. R. 1906.1. — *Relationship with Amphibia.* Semon, R. W. 1901.4; Zaddoch, E. G. 1873.1.*Fossil forms.* — *In Permian and Triassic, United States.* Cope, E. D. 1877.2, 1884.4, 6. — *"Ctenodipterinen" of the Devonian.* ★Pander, C. H. 1858.1. — *Silurian of Oesel I., Russia.* Rohon, J. V. 1893.1. — *Mesozoic and Cenozoic.* Stromer, E. 1910.2. — *Taxonomy.* Woodward, A. S. 1889.2.**Family Ctenodontidæ**

Palæozoic

Ctenodus. *Osteology.* Barkas, W. J. 1877.1, 1878.3, 4; Miall, L. C. 1878.2.*Relationships — to Ceratodus.* Hancock, A. & Atthey, T. 1871.1. — *to fossil Amphibian, Eurythorax.* Hussakof, L. 1916.1.**Family Ceratodontidæ****Ceratodus** (*fossil genus*). *Occurrence in Lower Mesozoic at Maledi, India.* Miall, L. C. 1878.3; Oldham, T. 1859.1.*Occurrence in Cretaceous.* Osborn, H. F. 1902.1; Haug, E. (*Sahara*) 1904.1; Chapman, F. (*New South Wales*) Add. 1914.1; Cope, E. D. (*Montana*) Add. 1876.1.*Occurrence in Jurassic.* Knight, W. C. 1898.1. — *Victoria.* Chapman, F. R. 1912.1; Woodward, A. S. 1906.5. — *Colorado.* Marsh, O. C. 1878.1–1878.3.*Occurrence in Permian.* — *Illinois.* Cope, E. D. 1875.4. — *Bohemia.* Fritsch, A. J. 1874.2.*Occurrence in Post-Pliocene.* De Vis, C. W. Add. 1884.1.*Occurrence in Triassic.* — *Hungary.* Beyrich, H. E. 1850.1. — *England.*

Browne, A. M. 1893.1; Richardson, L. 1906.1. — *Austria*. Teller, F. J. 1891.1. — *Silesia*. Volz, W. T. 1896.1. — *Africa*. Woodward, A. S. 1889.7.

Structure (mainly skull and teeth) and taxonomy. Egerton, P. G. & Miall, L. 1877.1; Fraas, E. 1889.1, 1904.1; Sandberger, C. L. 1877.1, 1879.1; Seeley, H. G. 1897.1; Stur, D. R. J. 1886.1; Zittel, K. A. 1886.1.

Neoceratodus (the recent form of *Ceratodus*). *General treatise with fine figures*. ★Günther, A. C. 1871.4. — *Discovery, early descriptions, etc.* Krefft, J. L. 1870.1–1871.2; Putnam, F. W. 1872.5; Anon. 385, 389, 573.

Natural history, popular accounts, notes, etc. Bancroft, T. L. 1912.1, 1914.1; Becker, E. E. 1901.1; Bruyère, H. 1901.1; Dean, B. 1912.1; Godet, P. 1880.1; Gervais, F. L. 1876.1; Harting, P. 1872.3, 1876.1; Hector, J. 1875.3; Hoffmann, C. K. 1872.1; Illidge, T. 1893.1; Keller, C. 1880.1; König, C. 1911.1; Lindes, L. 1880.3; Meyer, A. B. 1875.1; Newman, E. 1872.1; O'Connor, D. 1897.1; Peters, W. C. 1871.1; Schmeltz, J. D. 1875.1; Stoddart, W. W. 1875.1; Troschel, F. H. 1871.2; Anon. 257; Harald, — Add. 1914.1, 2; Palmer, — Add. 1906.1.

Phylogeny and relationships. — *Relation to Dipterus and Ctenodus*. Hancock, A. & Atthey, T. 1871.1. — *Considered as a "living fossil."* Tribolet, G. 1899.1.

Taxonomy. Castelnau, F. L. 1876.2; Günther, A. C. 1871.2, 1872.1; Anon. 130.

Family Lepidosirenidae

Taxonomy. Gill, T. N. 1894.1.

Lepidosiren. *General account with fine figures*. Lankester, E. R. 1896.1. — *Discovery, early descriptions, etc.* Fitzinger, L. J. 1837.2; Giglioli, E. H. (Rediscovery) 1887.2, 1888.2; Natterer, J. 1837.1; Schulz, W. A. (History of discovery) 1904.1.

Natural history, occurrence, etc. ★Baur, G. H. 1887.4; Bohls, J. 1894.1; Crane, A. 1877.1; Ehlers, E. H. 1894.1, 2; Goeldi, E. A. 1896.1, 1898.1, 2, 3; Günther, A. C. 1894.1; Harting, P. 1878.1; Heckel, J. J. 1845.1; Hoeven, J. 1837.1, 1839.1; ★Kerr, J. G. 1898.1; Leuckart, F. S. 1840.1; Merciai, G. 1906.1; Melville, A. G. 1847.1; Oken, L. 1838.1; Saint-Hilaire, A. F. 1846.1; Thompson, T. 1858.1; Howes, G. B. Add. 1893.1. — *Scarcity in European collections*. Slater, P. L. 1866.1.

Taxonomy, relationships, etc. Duméril, A. H. 1870.3; Edwards, H. M. 1840.1; Peters, W. C. 1866.6; ★Ribeiro, A. de M. 1909.1; Schneider, A. F. 1886.1; Hogg, J. Add. 1841.1. — *As an Amphibian*. Asmuss, H. 1856.1.

Protopterus. *General accounts with excellent figures*. Lankester, E. R. 1896.1; Peters, W. C. 1844.3, 1866.1.

For summer sleep, see Aestivation in the Morphological Section.

Natural history accounts, notes, etc. Boulenger, G. A. 1901.12; Brandes, G. 1893.1; ★Budgett, J. S. 1900.3, 1907.1; ★Dean, B. 1903.4; Gray, J. E. 1860.1; Halkett, A. 1901.1; Harting, P. 1864.2; Levander, K. M. 1897.2; Maitland, R. T. 1863.1; Marno, E. 1873.2; Merle, R. 1913.1; Moore, T. J. 1867.1; Newman, E. 1857.1, 1859.1; Palmén, J. A. 1900.1; Shufeldt, R. W. 1893.1; ★Wiedersheim, R. E. 1887.5; Beauregard, H. Add. 1889.1; Boyer, J. Add. 1913.2; Schulze, F. E. Add. 1889.1; Weltner, W. Add. 1896.1; Umlauff, H. Add. 1895.1. — *Distribution*. Schlüter, C. A. 1866.1.

Taxonomy and relationships. Duméril, A. H. 1870.3; Heckel, J. J. 1851.6; Schneider, A. F. 1886.1; Walter, J. A. 1873.1; Vaillant, L. L. 1899.3; Hogg, J. Add. 1841.1.

Fossil in Pliocene of Egypt. Stromer, E. 1914.2.

ORDER TELEOSTEI

True bony fishes

Taxonomy and relationships. ★Boulenger, G. A. 1904.7, 11, 12; Canestrini, G. 1859.3; ★Gregory, W. K. 1907.1; ★Regan, C. T. 1909.4, 1912.13. — *Classification of Physostomi*. Borsieri, C. 1910.1. — *Relations of Teleostei with ganoids*. Huxley, T. H. 1883.2. — *Review of Japanese Isospondyli*. Jordan, D. S. & Herre, A. C. 1906.1. — *Allotriognathi*. Regan, C. T. 1907.11. — *Zeomorphi*. Regan, C. T. 1910.1. — *Iniomi*. Regan, C. T. 1911.2. — *Palaeontological history*. Reis, O. M. 1895.3. — *Taxonomy of fossil forms*. ★Woodward, A. S. 1889.2.

Fossil forms from — Cretaceous. Cope, E. D. (United States) 1871.20; Cragin, F. W. (Kansas) 1901.7; Hay, O. P. 1903.2. — *Eocene, Wyoming, Green River shales*. Cope, E. D. 1870.5, 1877.1, 3. — *Tertiary, Idaho*. Cope, E. D. 1871.12.

SUB-ORDER MALACOPTERYGII

General account. Jordan, D. S. 1885.17. — *Of Denmark*. ★Otterstrøm, C. V. Add. 1914.1.

Taxonomy. — *Relationship of families composing*. Vaillant, L. L. 1883.1. — *Revision, African species*. Boulenger, G. A. Add. 1909.1.

Family Elopidae

Elops (*Big-eyed Herring*). — *E. macropus in Jurassic of France*. Prévost, C. 1824.1, Add. 1825.1. — *Taxonomy; revision*. Regan, C. T. 1909.14.

Megalops (*Tarpon or Tarpum*). *General popular treatises*. Pinckney, F. S. 1889.1; ★Dimock, A. W. Add. 1911.1.

Natural history accounts, descriptions, notes, etc. Bickerdyke, J. 1895.1; Clarke, S. C. 1874.1; Dunbar, G. P. 1882.1; ★Gill, T. N. 1907.6; Goode, G. B. 1874.5; Hutchinson, H. G. 1904.1; McIntosh, W. C. 1888.2; Murphy, J. J. 1880.1; Philips, B. 1874.8.

Family Albulidae

Albula (*Lady-fish, Bone-fish*). *Natural history*. Clarke, S. C. 1877.1; Evermann, B. W. 1902.19; ★Gill, T. 1907.6.

Family Mormyridae

For anatomy and functions of electrical organs, see under Electrical fishes.

For a map showing the distribution of the Mormyridae, see Meek, A. 1916.1 (p. 62).

General treatise. Marcusen, J. 1864.1.

Phylogeny and natural history. Kammmerer, P. 1906.1; ★Schlesinger, G. 1910.2, 4.

Taxonomy. — Revisions. ★Boulenger, G. A. 1898.17, 1901.22, Add. 1909.1; Marcusen, J. 1854.2, 1864.1. — *Synopsis*. Gill, T. N. 1863.2. — *German East Africa*. Pappenheim, P. 1906.2.

Mormyrus. *Natural history*. Babukhin, A. I. 1877.1.

Family Osteoglossidae

For maps showing the distribution of Osteoglossid fishes, see Boulenger, G. A. 1904.7 (p. 557), and Meek, A. 1916.1 (p. 60).

Taxonomy. Boulenger, G. A. 1901.19.

Family Pantodontidae

Pantodon. *Natural history of Pantodon, the freshwater flying fish of W. Africa*. Baird, S. F. 1876.13; Pellegrin, J. 1906.12; Popta, C. M. L. 1901.4.

Family Saurodontidae

Structure, taxonomy and occurrence in Cretaceous of Kansas. Cope, E. D. 1871.15, 1872.9, 1892.3; Crook, A. R. 1892.1; Stewart, A. S. 1898.4, 1899.3.

Ichthyodectes. *Taxonomy; synopsis*. Hay, O. P. 1898.3.

Portheus. *Structure and classification*. Cope, E. D. 1872.5; Hay, O. P. 1898.4, 5; Longman, H. A. 1913.1; Osborn, H. F. 1904.1; Woodward, A. S. 1913.1.

Occurrence in Cretaceous of — Bohemia. Bayer, F. 1908.1, 1909.1. — *Kansas*. Cope, E. D. 1873.4; Sternberg, C. H. 1907.1, 1909.1; Williston, S. W. 1894.2. — *Africa*. Jaekel, O. 1909.1. — *Italy*. Mariani, E. 1902.1. — *British Isles*. Newton, E. T. 1877.2. — *Queensland*. Woodward, A. S. 1894.6.

Family Chirocentridae

Taxonomy: Sunda-Molucca forms. Bleeker, P. 1852.3.

Family Clupeidae

Herrings, Pilchards and Sardines, Shads, Alewives.

Natural history. Cuvier, G. & Valenciennes, A. 1848.1; Knox, R. 1846.1; Prince, E. E. 1907.1; Tracy, H. C. 1906.1; Widegren, H. 1872.2, 3, 1876.1. — *Of Caspian Sea species*. Borodin, N. A. 1905.2. — *Of Pacific coast forms*. Lockington, W. N. 1880.8. — *On coasts of Devon and Cornwall*. Dunn, M. Add. 1886.1, 1894.1.

Taxonomy. Bleeker, P. 1862.1 (vi), 1866.2; Fowler, H. W. 1911.6; Valenciennes, A. 1846.1. — *Caspian Sea; review*. ★Berg, L. S. 1913.5. — *Black Sea*. Brauner, A. 1912.1, 2. — *S. African species*. Gilchrist, J. D. 1913.3. — *Bonin Is.* Kishinouye, K. 1911.1. — *Pacific coast*. Lockington, W. N. 1880.15. — *Australia*. Macleay, W. 1880.3. — *Baltic Sea*. ★Schneider, G. 1908.2. — *Relation to Ganoidei*. Stannius, F. H. 1846.1.

Nomenclature. Goode, G. B. 1878.3; Philips, B. 1878.4.

Fossil forms; occurrence and geological significance. Rzehak, A. 1881.1, 1887.1. — *in Eocene of Monte Bolca*. Liroy, P. 1865.3. — *in Miocene of Transcaucasia*. Bogacev, V. V. Add. 1913.1.

Sub-family Engraulinae

Engraulis (*Anchovy*). — *Complete literature and plate of larval forms*. ★Hoek, P. P. 1903.1. — *General treatise*. ★Hoek, P. P. & others. 1886.1.

Natural history. ★Fage, L. 1911.2; Fulton, T. W. 1902.1, 1905.2; Hoek, P. P. 1891.2, 1892.1; Marion, A. F. 1894.6, Add. 1889.1; Anon. 102. — *Japanese forms*. Nishikawa, T. 1901.1. — *Local races*. Fage, L. 1911.3; Lo Giudice, P. 1911.1, 2.

Occurrence. — English coast. Calderwood, W. L. 1892.2; Cunningham, J. T. 1889.1. — *Balearic Islands*. Racovitza, E. G. 1905.1.

Sub-family Clupeinae

For maps showing the geographical distribution of the herrings and shads of the genus Clupea, see Meek, A. 1916.1 (pp. 104, 105).

Taxonomy. — Black Sea forms. Antipa, G. 1905.1. — *Synopsis*. Gill, T. N. 1862.28. — *British species*. Regan, C. T. 1916.1.

Alosa sapidissima (*American Shad*). *Natural history, occurrence, etc.* Ascroft, R. L. 1900.1; Evermann, B. W. 1902.1, 1906.13. — *In Hudson R.* Cheney, A. N. 1896.8, 1900.1. — *At Beaufort, North Carolina*. Anon. 405.

Brevoortia (*Menhaden*). *General treatise*. Goode, G. B. 1879.7.

Natural history. Gilpin, J. B. 1863.1; Goode, G. B. 1879.2, 9, 1880.17; Mosher, G. 1882.1; Stearns, S. 1879.1.

Taxonomy and nomenclature. — Revision, American species. Goode, G. B. 1878.11. — *Popular names*. Goode, G. B. 1878.13. — *Etymology of names*. Trumbull, J. H. & Josselyn, J. Add. 1879.1.

Clupea alosa (*Allis Shad*). *Natural history*. Hoek, P. P. 1897.3; Pollen, F. 1872.1; Pouchet, G. & Biérix, E. 1889.1, 2; Reidel, W. 1894.1; Cunningham, J. T. Add. 1895.3.

Clupea finta (*Twait Shad*). *Natural history*. ★Ehrenbaum, E. 1896.1; Noël de la Morinière, S. B. 1810.1; Pouchet, G. & Biérix, E. 1889.1; Supino, F. 1908.4. — *In lakes of northern Italy*.

Barbieri, C. 1908.3; Besana, G. 1908.2.
— *On English coast*. Hogg, J. 1870.1.

Clupea harengus (*Sea Herring*).
General treatises. Bock, F. S. 1769.1, Add. 1768.1; Caux, J. W. 1881.1; ★Heincke, F. 1898.1; Møller, J. M. 1865.1; ★Valenciennes, A. 1847.1. — *Complete literature, with plate of larval forms*. ★Hoek, P. 1903.1.

Migration and distribution. Baird, S. F. 1878.5; Broch, H. 1908.1, 2; Cligny, A. 1912.9; Duncker, G. 1899.1; Gilpin, J. 1786.1; Lindahl, J. 1878.1; Mitchell, J. M. 1861.1; Morrison, W. D. 1829.1; Noël de la Morinière, S. 1795.1; Nordgaard, O. 1905.1; Schneider, J. G. 1788.2; Sim, G. 1883.2; Watt, W. 1883.3; Ziegler, A. 1857.1; Anon. 366. — *English Channel*. Canu, E. 1897.1. — *In Baltic Sea*. Hinkelmann, A. 1908.1. — *Results of the international herring investigations, 1907-1911*. Hjort, J. 1908.1, 1910.2; Hjort, J. & Lea, E. 1911.1, 1912.1. — *Effect of climate*. Krebs, W. 1911.1. — *Syllt, Prussia*. Lübbert, H. O. 1904.1.

Natural history. Growth and age. Cunningham, J. T. 1891.4; Harting, P. 1879.3; Jenkins, J. T. 1903.1. — *In Baltic Sea*. Meyer, H. A. 1878.1, 2.

Natural history; text in English. Ewart, J. C. 1883.1, 1884.1, 2, 1888.3; Ewart, J., Gibson-Maitland, J. & others. 1884.1; Fraser, A. 1830.1, 1833.1; Gilpin, J. B. 1863.1; Heincke, F. 1899.1; Holt, E. W. L. 1889.1; Huxley, T. H. 1881.1; Knox, R. 1834.1; Kyle, H. M. 1899.1; Ljungman, A. V. 1882.2; Meyer, H. A. 1880.1; Mitchell, J. M. 1860.1, 1863.1, 2, 1864.1; Robertson, D. 1869.1; Warren, R. 1906.1; ★Williamson, H. C. 1910.2; Anon. 146, 469. Dodd, J. Pre-Linn. 1752.1.

Natural history; text in French. Cligny, A. 1904.1; Dulac, A. 1765.1; Giard, A. 1903.4, 1904.1; Noël de la Morinière, S. B. 1789.1; Sauvage, H. E. 1888.2.

Natural history; text in German. Ehrenbaum, E. 1909.2; Ekström, C. 1845.1; Lübbert, O. 1864.1; Nilsson, S. 1860.1; ★Simroth, H. R. 1910.1; Storch, O. 1915.1; Wilson, S. 1861.1; Anon. 276, 277, 378, 579, 615, 649; Heincke, F. Add. 1884.1.

Natural history; text in various languages. — *Danish*. Ljungman, A. V. 1879.1, 3; Otterström, A. N. 1910.1. — *Latin*. Anon. 750; Hartung, V. Pre-Linn. 1615.1; Mattheus, A. Pre-Linn. 1649.1. — *Russian*. Pavlenko, M. N. Add. 1914.1. — *Swedish*. Ekström, C. U. 1844.2; Trybom, F. (*Reproductive organs*) 1901.1.

Races of herring. Broch, H. 1908.1, 2; Meek, A. 1914.1; Meek, A. & Storrow, B. 1912.1-1913.1; ★Orton, J. H. 1916.1; Scupin, E. 1910.1; Smitt, F. A. 1888.1; ★Stacy-Watson, C. 1894.1. — *Researches into European races, with methods*. ★Williamson, H. C. 1914.1. — *Species inhabiting the Oresund*. Winther, G. P. 1876.3, 1878.2. — *Heincke's investigations*. ★Heincke, F. 1877.1, 1898.1, 1899.1; Redeke, H. C. 1901.2. — *Ap-*

plication of Heincke's method to English waters. Riddell, W. 1914.1, 1915.1.

For *Clupea alba*, the young of *C. harengus*, see Whitebait under Fisheries by subjects.

Clupea pilchardus (*Pilchard*). *Natural history*. Cépède, C. 1907.2; Cornish, T. 1870.5, 1879.1; Cunningham, J. T. 1892.4, 1893.6; Couch, J. 1865.1; Dunn, M. 1892.1; ★Fage, L. 1912.3, 1913.1; Fulton, T. W. 1904.1; Hoek, P. P. 1913.2; Fage, L. & Legendre, R. Add. 1914.1.

Natural history of the Sardine, the immature form of the Pilchard. Cuvier, G. L. & Valenciennes, A. 1848.1; ★Kishinouye, K. 1907.3. — *On French and Italian coasts*. ★Mader, C. 1909.1; Marion, A. F. 1889.1-1891.2, 1894.10, 11, Add. 1889.2; Pouchet, G. 1886.1-1891.3; Pouchet, G. & Biétreix, E. 1892.1; Steuer, A. 1908.1; Henneguy, L. F. Add. 1891.1; Joubin, L. Add. 1913.1.

Papers dealing especially with the Sardine will be found chiefly under Fisheries, Sardine.

Clupea sprattus (*Sprat*). *Natural history and occurrence*. Costa, O. G. 1844.2; Noël de la Morinière, S. B. 1798.1. — *In New Zealand*. Arthur, W. 1883.1. — *In Baltic Sea*. Schneider, G. 1895.1. — *In Norway*. ★Sund, O. 1909.1, 1910.1, 2.

Clupea, in *Caspian Sea and Sea of Azov*. — *Sea of Azov*. Grimm, O. 1901.1.

Natural history of species of Caspian Sea and Volga R. Borodin, N. A. 1896.1, 1904.1; Kuznetzov, I. D. 1904.1; Pel'tzam, E. D. Add. 1886.1. — *C. caspia*. Arnold, D. J. 1907.1; Kuznetzov, I. D. 1894.1; Suvorov, E. K. (*taxonomy*) 1907.3. — *C. cultiventris and C. engrauliformis*. Borodin, N. A. 1905.3, 1906.1. — *C. kessleri*. Dikson, B. 1905.2, 3.

Clupea. *Fossil forms*. — *in Sardinia*. Bassani, F. 1900.1. — *in Cretaceous and Tertiary of Croatia*. Kner, R. 1863.3. — *Eocene of Wyoming*. Leidy, J. 1857.1. — *Oligocene, Isle of Wight*. Newton, E. T. 1889.2. — *Tertiary of France*. Sauvage, H. E. 1881.1.

Dorosoma (*Gizzard Shad*). *Taxonomy*. Jordan, D. S. 1877.1.

Diplomystus. *Recent forms*. — *in freshwater of Australia*. Woodward, A. S. 1892.2. — *Relation to Potamolosa and Hyperlophus*. Ogilby, J. D. Add. 1896.1.

Fossil forms. — *in Tertiary of Africa*. Eastman, C. R. 1912.2. — *in Cretaceous of Brazil*. Mawson, J. & Woodward, A. S. 1907.1.

Pomolobus (*Alewife, or River or Branch Herring*). *How to distinguish the two species of river herring*. Goode, G. B. 1879.16, 1880.13.

Fisheries, United States. Smith, H. M. 1899.6; Crittenden, A. R. Add. 1884.1. — *Massachusetts*. Field, G. W. 1914.1. — *Potomac R.* Harris, G. 1884.1-1887.1. — *Louisiana*. Harrell, J. D. Add. 1884.1. — *North Carolina*. Milner, J. W. Add. 1882.1; Worth, S. G. Add. 1884.1.

Natural history, occurrence, etc. Bean, T. H. 1884.7; Green, S. 1880.1; ★McDonald, M. 1884.5; Milner, J. W. 1880.4; Yarrow, H. C. & Milner, J. W. 1874.1.

FAMILY SALMONIDÆ

For a map showing the geographical distribution of the Salmonidæ, see Boulenger, G. A. 1904.7 (p. 566).

Distribution

General. Bean, T. H. 1888.2; Blyth, E. 1865.1; Norris, T. 1862.1.

Northernmost salmonoid, Salvelinus arc-turus from Victoria Lake and Floe-Berg Beach. 82° 28' N.; Günther, A. 1877.1. — [Peary Exped. collected trout in outlet of Lake Hazen, still farther north.] — *S. stagnalis in Arctic circle.* Bean, T. H. Add. 1886.1.

Southernmost New-world distribution; Salmo mykiss (S. Clarkii) in Chihuahua. Cope, E. D. Add. 1886.3. — *S. nelsoni in Lower California.* Evermann, B. W. 1908.1.

Southernmost Old-world distribution; Salmo macrostigma in Algeria. Duméril, A. H. 1858.3, 1863.1; Zill, — (*S. lapas-seti*) 1858.1. — *in Sardinia.* Boulenger, G. A. 1900.15. — *in Pontine marshes, Italy.* Vinciguerra, D. 1902.1.

Southernmost Asian distribution; Salmo orientalis in northern Afghanistan. M'Clelland, J. 1835.1, 1843.1. — *Phylogeophyra in the Altai Mts.* Boulenger, G. A. 1898.11.

Embryology

Because of the ease in securing them, salmonid eggs have served as the basis of most of the embryological work on fishes. The following represent a few of the more important general researches. ★Henneguy, L. F. 1888.1; ★His, W. 1874.2, 1876.1, 1878.1, 1879.2, 1880.1; Jablonovskij, J. 1898.1; Kopsch, F. 1894.1, 1898.1; Lereboullet, D. A. 1861.1; Oellacher, J. 1879.1; Ryder, J. A. 1885.6; ★Vogt, C. C. 1842.1; Ziegler, H. E. 1882.1.

Fossil forms

Rhabdofario lacustris from Pleistocene at Catherine's Creek, Idaho. Cope, E. D. 1871.12.

Thaumaturus and Prothymallus from Lower Miocene of Bohemia. Laube, G. C. 1900.1, 2.

Taxonomy

Key to genera. Bean, T. H. 1888.4. — *Cranial characters.* Boulenger, G. A. 1895.10. — *Differential characters of Salmonidæ and Thymallidæ.* Gill, T. N. 1895.1, Add. 1896.1. — *Systematic arrangement.* ★Regan, C. T. 1914.11.

General treatises. *Encyc. article.* Cunningham, J. T. 1886.3. — *See also acc't by* ★G. A. Boulenger, *Encyc. Brit.* 1911, vol. 24, p. 82.

For a complete taxonomic account to 1866, see vol. VI of ★Günther, A. 1859.1.

General treatises on American Salmonidæ. Garman, S. 1885.1. — *Note on this.* Jordan, D. S. 1886.4; Suckley, G.

1860.1–1874.1. — *Note on this.* Baird, S. F. Add. 1874.2. — *See especially* ★Jordan, D. S. & Evermann, B. W. 1896.2, 1902.1.

General treatises on the Salmonidæ of Europe. Fatio, V. (Vol. 5) 1882.1; Kavraiskii, T. T. 1896.1; ★Smitt, F. A. 1882.1, 1886.1.

British and Irish Salmonidæ. ★Day, F. 1887.1; Holt, E. W. & Byrne, L. W. 1913.1; Jardine, W. 1834.3, 1839.1, 2. — *See especially, acc't in* ★Regan, C. T. 1911.8.

Salmonidæ of Japan. Hilgendorf, F. M. 1876.1; Jordan, D. S. 1902.11, 1905.3; ★Jordan, D. S. & Snyder, J. O. 1902.6; Kitahara, T. 1904.2.

SUB-FAMILY SALMONINAE The Salmon and Trouts

For a map showing the geographical distribution of the Atlantic and Pacific Salmon and Trouts, see Meek, A. 1916.1 (p. 114).

SALMO (TROUTS)

American trouts

For the best systematic accounts, see Garman, S. 1885.1; ★Jordan, D. S. & Evermann, B. W. 1896.2, 1902.1. — *Popular acc't.* Sage, D. & others. 1902.1.

Miscellaneous. Chamberlain, F. M. 1907.1; Gibbons, W. P. 1876.1; Gilpin, J. B. 1863.1; Jordan, D. S. 1894.4, Add. 1892.1, 2; Land, S. E. 1913.1; Stone, L. 1872.5.

Salmo gairdneri. *Steelhead Trout series.* — *S. kamloops in Kootenay Lake.* B. C. Jordan, D. S. & Snyder, J. O. 1908.2.

Salmo clarkii. *Cut-throat Trout series.* — *Popular acc't.* Evermann, B. W. 1903.1. — *S. eremogenes, n. sp. = S. clarkii.* Evermann & Nichols, J. T. 1909.1. — *Misc.* Jordan, D. S. 1885.10. — *S. virginalis of Utah Lake.* Yarrow, H. C. 1874.3.

Twin Lake (Colo.) trouts — S. stomias. Cope, E. D. 1875.9; Juday, C. 1907.2. — *S. macdonaldi.* Jordan & Evermann. 1890.1.

Lake Tahoe (Cal.) trouts. — *S. henshawi, and S. tahoensis.* Juday, C. 1907.1. — *S. regalis.* Snyder, J. O. 1912.4.

Salmo irideus. *Rainbow Trout series.* — *Popular acc't.* Bean, T. H. 1896.2. — *Original description.* Gibbons, W. P. 1855.1.

Golden trout, S. aqua-bonita of the south fork of Kern R., Cal. Evermann, B. W. 1904.3, 4, 1906.7, 14; Jordan, D. S. 1893.1, Add. 1892.3; Juday, C. (Food) 1906.1.

S. roosevelti, and S. whitei, n. sps., golden trouts of Kern R. region. Evermann, B. W. 1906.7.

European trouts

Taxonomy, species — of Europe. Agassiz, J. L. 1834.6; Günther, A. 1895.1. — *of British Isles.* Day, F. 1883.6. — *of Central Europe.* Heckel, J. J. & Kner, R. 1858.1. — *of Caucasian regions.* ★Kavraiskii, T. 1896.1, 1899.1.

Trout, "Carpione" of the Lake of Garda (S. carpio). Betta, F. E. 1891.1; Heckel, J. J. 1852.5; B., J. Add. 1899.2.

Salmo trutta. All British trouts are now considered to belong to a single variable species, *S. trutta* (*S. fario*, syn.). For convenience in reference however the following sub-divisions are retained.

General treatises on natural history and the trout as a game fish. Granby, — 1898.1; Harvie-Brown, J. A. 1898.1; Jourdeuil, E. 1872.1; ★Lamond, H. 1916.1; ★Malloch, P. D. 1910.1; Maxwell, H. E. 1898.1; Petit, G. 1897.1; Phillips, E. 1914.1.

Growth, biometric correlations. Jenkinson, J. W. 1912.1. — "Yellow fins," as second year trout. McIntosh, W. C. 1871.1; Flowerdew, H. Add. 1883.1.

Gillaroo or gizzard trout of Irish lakes (S. stomachius). Barrington, D. 1774.1; Hunter, J. 1774.2; Thompson, W. 1849.1; Walsh, J. 1774.1; Watson, H. 1775.1.

Loch Leven trout (S. levenensis), status. Day, F. 1890.3.

"Tailless trout" of Loch-na-Maorachan in Islay, Scotland (S. islayensis). Peach, C. W. 1871.1; Thomson, J. 1873.1; Traquair, R. H. 1872.1, 1882.2, 1892.5.

Sea-trout, Bull-trout, or Salmon-trout (S. eriox), i. e. references to marine or estuarine forms. Growth, habits, migrations, etc. Barfurth, D. 1874.1-1886.1; Blackwall, J. 1850.1; Brotherson, A. 1882.1; Calderwood, W. L. 1904.4; Cligny, A. 1907.1, 1912.12, Add. 1907.3; Dahl, K. 1911.1; Giard, A. 1892.2; Green, R. Y. 1889.1; Hoek, P. P. 1892.2; Jardine, W. 1830.1, 1834.1; Klunzinger, C. B. 1885.1; Nordgaard, O. 1896.1-1897.2; Shaw, J. 1843.1; Sicard, A. 1865.1; Vacher, — 1892.1; Williamson, H. C. 1896.1. — *Bull-trout of Tay is in reality the salmon.* Calderwood, W. L. 1906.1.

SALMO SALAR

(Atlantic Salmon)

References to American forms

For popular accounts, see ★Jordan, D. S. & Evermann, B. W. 1902.1; Sage, D. & others. 1902.1.

Records of capture of Atlantic salmon at sea. Kendall, W. C. & Smith, H. M. 1895.1; Smith, H. M. 1895.2.

Records of reappearance in Connecticut R., due to planting. Baird, S. F. 1876.1; C., G. H. 1878.1; Chalmers, T. 1878.4; G. — 1876.1; Gladwin, C. O. 1876.2; Philips, B. 1878.11.

Marking experiments at Bucksport on Penobscot R., Maine. Atkins, C. G. 1885.1.

Miscellaneous papers on habits, etc. of salmon. D., R. G. 1879.1; Gilpin, J. B. 1873.1, Add. 1879.1; Hind, H. Y. 1880.1-4; Lord, W. S. (weights) 1882.1; Thacher, J. & Smith, S. 1874.1; Henry, W. Add. 1838.1.

Salmo salar ouananiche. Ouana-

niche or Winninich of Lake St. John, Saguenay R., and Quebec.

Popular general accounts. Chambers, E. T. 1896.1; McCarthy, E. 1894.1.

Miscellaneous papers. Boardman, G. A. 1875.1; Evermann, B. W. 1896.4; Grant, M. 1898.1; Huard, V. A. 1900.1, 2; Maisson, E. 1897.3, 1899.1; Anon. 481, 699.

Salmo salar sebago. *Landlocked or Sebago salmon of Maine, New Hampshire, and New Brunswick.*

Miscellaneous items. Baird, S. F. 1871.26; Bean, T. H. 1889.11, 1890.41, 1891.10; Bowles, B. F. 1873.1; Jordan, D. S. 1878.4; Methuany, J. M. 1879.1; Philips, B. 1874.4; R., R. 1874.1; Stone, L. 1871.1.

References to European form

Popular articles on the salmon. Day, F. 1882.10; ★McIntosh, W. C. 1914.1.

Chemical composition of flesh; red color due to lipochrome pigment corresponding to tetron- or zoonerythrin. Christison, R. 1872.1; Kensington, E. T. 1884.1; ★Newbigin, M. I. 1900.1; Prince, E. E. 1916.2.

Thames as a salmon river. Marston, R. B. 1899.1; Venables, G. 1858.1, 1874.1.

Further relatively unimportant references to salmon will be found below, under Miscellaneous references.

General treatises. (Text in English.) *Life-history and habits.* Brown, W. 1862.1; ★Calderwood, W. L. 1907.1, 1909.2; Davy, H. 1828.1; Fitzgibbon, E. & Young, A. 1850.1; Hardy, A. E. 1898.1; ★Malloch, P. D. 1910.1; Maxwell, H. E. 1898.1; Traherne, J. P. 1889.1; Willis-Bund, J. W. 1885.1.

Growth. *Young stages, etc., observations on, and controversy over status of the botcher, gillion, grilse, gravelling, parr, samlet, etc.* Andrews, W. 1849.1, 2; Carr, J. 1810.1, Add. 1830.1; Cornish, T. 1868.6; Fryer, C. E. 1873.1; G., T. 1834.3; Jenkins, T. 1840.1; Wilson, J. 1840.1; Young, A. 1842.1-1854.1; Flowerdew, H. Add. 1883.1.

Parr proved to be young salmon by hatching and rearing fry to the parr stage. Shaw, J. 1836.1-1850.1. — *Color plates of growth during first two years.* Yarrell, W. 1839.2.

Exhibit of transition from smolt to grilse. Calderwood, W. L. 1906.3, 4. — *Alleged arrested development, when retained in fresh water.* Murie, J. 1868.1, 1870.1.

Life and growth of smolts in the open sea; feeding habits; return as grilse, etc. ★Dahl, K. 1911.1; Archer, W. E. Add. 1893.1.

Size attained by salmon. — 49 lb. spm. from R. Maas, Holland. Hughes, W. R. 1875.1. — *Large spms. from Severn and Wye.* — 80 lb. spm. Jones, W. 1873.1. — 42 and 52 lb. spms. Sweetapple, E. 1867.1. — 43 lb. spm. Anon. 364.

Study of scales, "scale reading" for determination of growth, migrations, etc. Dahl, K. 1910.1; Esdaile, P. C. 1912.1,

1913.1; Hoek, P. P. 1909.2; Hutton, J. A. 1913.1, Add. 1909.1; ★Johnston, H. W. 1907.1, 1911.1; ★Masterman, A. T. 1913.1; Menzies, W. J. 1913.1.

Metabolism during sojourn in fresh water; question of feeding, etc., text chiefly in English. [Now generally accepted that salmon do not feed while in fresh water.]

Important treatises including papers on growth of the genitalia. Archer, W. E. 1900.2; ★Hoek, P. P. 1891.4, 1894.2, 1894.4, 1896.2, 1899.1; ★Miescher-Ruesch, F. 1883.1, 1879.1-1896.1, Add. 1897.1; ★Paton, D. N. 1897.1-1908.1, 1898.1; Paton, D. N. & Newbigin, M. I. 1902.1. — *Popular résumé of Miescher*. Henderson, Y. 1902.1.

Minor papers regarding the question of feeding in fresh water. Barfurth, D. 1876.1; Blackwall, J. 1843.1, 1850.1; Braithwaite, G. F. 1863.1; Buckland, F. T. 1879.1; Corbin, G. B. 1874.1; Halliburton, W. D. 1898.1; Houghton, W. 1868.1; Keene, J. H. 1879.3; McIntosh, W. C. 1864.1; Stark, John. 1840.1.

Researches, on the anatomy and histology of the intestine with regard to the possibility of food-taking. — *Degeneration of lining membrane of stomach*. Gulland, G. L. 1898.1, 2, 1900.1. — *Denial of this*. Barton, E. L. 1900.1-1904.1; Brown, A. B. 1898.1. — *Low activity of digestive processes*. Gillespie, A. L. 1898.1. — *Muscle fat, histology*. Mahalanobis, S. C. 1898.1, Add. 1898.1. — *Examination, stomachs of 514 fish at Berwick-on-Tweed*. Tosh, J. R. 1895.1.

For Protamines, discovered by Miescher in salmon sperm, see Chemical composition under Spermatozoa. See also Duration of virility under Spermatozoa.

Migrations. Miscellaneous. Benecke, B. 1886.2; Carr, J. 1809.1; Day, F. 1886.1; Nordqvist, O. F. 1906.3; Willis-Bund, J. W. 1902.1, 1905.1.

Relation to water temperature, etc. ★Calderwood, W. L. 1898.1, 1901.3, 1903.3, 1905.1. — *Capture at sea*. Cornish, T. 1881.6. — *Reach headwaters of Vistula R. in Carpathians*. Lindes, L. 1880.5. — *Influence of dissolved oxygen*. Roule, L. 1914.3, 4, 1915.2.

Migrations in Baltic and North Seas. ★Dahl, K. 1902.1, 2, 1906.3; Fiedler, J. 1885.1; Malmgren, A. J. 1884.2.

Supposed land-locked form, S. salar in Waterford Co., Ireland. Scharff, R. F. 1896.2.

Marking experiments for determination of migrations, growth, etc. — in *Tay, and Tweed, England*. Calderwood, W. L. 1902.1, 1906.3, Add. 1911.1, 2, 1914.2; Smith, G. 1861.1. — in *Ireland*. ★Hillas, A. B. 1904.1. — in *Germany*. Häpke, L. 1895.1; Virchow, R. & Hensen, — 1872.1; Nierstrass, H. F., Nengermann, A. A. & Kerbert, C. Add. 1911.1. — in *Norway*. Landmark, A. 1892.1. — in *Finland*. Nordqvist, O. F. 1897.2. — *Salmon marked in Finland, captured in Denmark and Ger-*

many. Sandman, J. A. 1906.3, 1907.1, 1909.1. — in *Baltic Sea*. ★Trybom, F. 1908.1, 1910.1.

Reproduction. — *Sexual differences at breeding time and their causes*. Barrett-Hamilton, G. E. 1900.1, 1902.1. — *Range of spawning season in Scotland, sex-ratio, etc.* ★Calderwood, W. L. 1901.1, 1904.1. *Experiments at Plymouth laboratory*. Crawshay, L. R. 1908.1. — *Salmon do not spawn at sea*. Day, F. 1882.3, 1886.4. — *Exchange of pigments between muscle and ovary*. Newbigin, M. I. 1900.1.

Infrequency of spawning as shown by scales. Calderwood, W. L. 1910.1; Menzies, W. J. 1912.1, 1914.1.

Marine existence unnecessary for reproduction. — *Breeding of smolts which have never been to sea*. Calderwood, W. L. 1905.2; Day, F. 1888.4. — *Male kept a year and found again ripe*. Calderwood, W. L. 1908.1.

PACIFIC SALMONS

Of the genus *Oncorhynchus*

Popular accounts, magazine articles, etc., on the life-histories and habits of the Pacific salmon. Bean, T. H. 1890.1; Jordan, D. S. 1881.6, 1894.4, 1903.4; ★Rutter, C. M. 1902.1, 1903.1; Stone, L. 1884.1; Townsend, C. H. & Smith, H. M. 1902.1. — See also ★Jordan, D. S. & Gilbert, C. H. 1881.1. Reprinted in Jordan & Evermann, 1902.1.

Color plates of all species. ★Evermann, B. W. & Goldsborough, E. L. 1906.2.

Chinook names of Columbia river salmon. Smith, Silas B. 1881.1.

Death after spawning. *Belief of Stone that all die, disbelief of this by others and the attendant controversy.* Bean, T. H. 1891.6; Dunn, H. D. 1880.1; Major, — 1879.1; Redding, B. B. 1879.2; Stone, L. 1880.1.

First conclusively shown that all die after spawning. Evermann, B. W. 1897.5.

Death invariably follows spawning, (in reared, uninjured salmon at the Trocadero aquarium in Paris) — thus, a deep-seated, specific phenomenon. Juillerat, E. 1905.1.

Growth and reproduction. *Natural history, etc.* — in *Alaska*. Bean, T. H. 1885.5, 1894.4. — *Figures, fry of all species.* ★Chamberlain, F. M. 1907.1. — *Age at maturity.* Gilbert, C. H. 1912.1.

Investigations ★, on life histories in headwaters of the Columbia R. Evermann, B. W. 1896.3, 1897.5; Evermann & Meek, S. E. 1898.1; Evermann & Scovell, J. T. 1895.2; Gilbert, C. H. & Evermann. 1895.1.

Marine existence unnecessary — breeding of chinooks for several generations in fresh-water at the Trocadero. Jousset de B., G. 1897.2; Raveret-W., C. & Bartet, — 1873.1.

Scale markings studied for determination of the life-cycle. ★Gilbert, C. H. 1912.1, 1914.1; McMurrich, J. P. 1911.1, 1913.2, 1914.2; Milne, J. A. 1913.1.

Blue-back, red, or sockeye salmon, O. nerka. — Kennerley's salmon as a small variety. Bean, T. H. 1891.9; Bendire, C. E. 1878.1–1882.1. — Note. Brew, C. 1861.1. — Popular acc'ts. Evermann, B. W. 1902.16; Green, A. 1891.1,2. — Natural history. ★Gilbert, C. H. 1912.2, 1914.1.

Chinook or Quinnot salmon, O. tschawyt-scha. — Investigations of natural history in the Sacramento R. ★Rutter, C. M. 1904.1. — Habits, size, non-feeding in fresh-water, etc. Cobb, J. N. 1910.1; Goudy, J. (82 lb. spm.) 1878.1; Stone, L. 1874.2, 1884.6, 1895.1. — Intestine, anatomy. Greene, C. W. 1912.3. — Musculature. Greene, C. W. 1913.1; Greene, C. W. & Greene, C. H. Add. 1914.1.

Migrations. — Speed of migrating salmon. Greene, C. W. 1910.1,2, 1911.1. — Storage of fat in muscular tissues and its resorption during migrations. ★Greene, C. W. 1912.1–6, Add. 1914.1,2. — Parent stream theory. Jordan, D. S. 1903.2. — Experiment in land-locking quinnat salmon. Parker, H. G. 1878.1. — Migrations as shown by parasites. Ward, H. B. 1908.1. — Factors which control leaping. Ward, H. B. 1910.1,3,4.

Marking experiments on Columbia R. Greene, C. W. 1910.1,2, 1911.1; Smith, H. M. 1904.12, 1905.7, Add. 1905.1.

SALVELINUS (CHARRS)

For a map showing the geographical distribution of the Charrs, see Meek, A. 1916.1 (p. 132).

American forms

General treatises on the American charrs. Garman, S. 1885.1; Jordan & Evermann, 1896.2; ★Kendall, W. C. 1905.2, 1914.2.

Salvelinus bairdii (*S. malma*). Dolly Varden trout of the Pacific slope. — Color plate. Evermann, B. W. & Goldsborough, E. L. 1906.2. — In British Columbia. Lord, J. K. 1867.3.

S. marstoni. Lac de Marbre trout of the Prov. of Quebec. Garman, S. 1893.1; Titcomb, J. W. 1901.1; Halkett, A. Add. 1914.1.

S. (Cristivomer) namaycush. Great Lake trout. — Color plates. Jordan, D. S. & Evermann, B. W. 1911.1; Kendall, W. C. 1914.2. — Popular accounts, etc. Adams, A. L. 1874.1; Jordan, D. S. 1889.6; Tomlin, W. D. 1896.1.

S. oquassa. Blueback trout of Rangeley lakes, Maine. Baird, S. F. 1874.4; Bullen, A. 1879.1; ★Kendall, W. C. 1905.2, 1914.2; Kingsbury, C. A. 1874.1; Page, G. S. 1874.2.

S. aureolus. Golden trout of Sunapee Lake (N. H.), and Flood Pond, Maine. — Original description. Bean, T. H. 1887.6. — Color plates. ★Kendall, W. C. 1913.1, correctly in Rept. U. S. Bur. Fish., 1912 (1914).

Popular acc'ts, controversy over question whether native or introduced, etc. Bean, T. H. 1886.2, 1889.26, 1890.14 (also pp. 429, 435), 1891.20; Quackenbos, J. D.

1893.1, 1896.1; Thompson, W. T. 1904.1; Jordan, D. S. Add. 1891.1.

S. fontinalis. Brook trout. — As a game fish; habits, variations, etc. Bigelow, S. L. 1848.1; Bradford, C. B. 1900.1; Forsyth, J. B. 1847.1; Day, F. 1882.9; Jordan, D. S. 1884.1; Needham, J. G. (Food) 1903.1, 1908.1; Raveret-Wattel, C. 1878.2; Rhead, L. (Gen. treat.) 1902.1; Whish, J. D. 1906.1; Ellis, W. H. Add. 1883.1. — Albinos. Bean, T. H. 1911.1; Pettis, C. R. 1903.1. — Behavior of fry. White, G. M. 1915.1.

European forms

British charrs. For the best account of the British and Irish species, see ★Regan, C. T. 1911.8. See also Regan, C. T. 1908.16, 1909.1,3,10, 1910.4.

Natural history, taxonomy, etc. Biedie, G. 1896.1; Brown, Alfred W. 1896.1; Davy, J. 1852.1; ★Günther, A. 1862.1, 1865.1,5; Knox, R. (Anatomy) 1845.1; O., — 1832.1; Thompson, W. 1841.1; Farrington, Pre-Linn. 1756.1. — *S. alpinus* in Hebrides Is. Günther, A. 1882.1. — *S. killinensis* in Inverness-shire. Traquair, R. H. 1898.3.

Charrs of Continental Europe. — Taxonomy. Heckel, J. J. 1851.1,4; Hilgendorf, F. M. 1891.3; Smitt, F. A. 1886.1.

S. alpinus in Norway and Sweden. Ekman, S. 1912.1; Grieg, J. A. 1908.2; Lönnberg, A. J. 1895.6; Stejneger, L. 1909.1.

S. (Hucho) hucho of the Danube R. — Miscellaneous (Text in German). Haempel, O. 1910.1; Robida, I. 1902.1; Rüdinger, N. 1870.1; Salomon, K. 1908.1; Schrank, F. P. & Wartmann, B. 1780.1; T., M. 1866.1; Anon. 15, 589; Koelreuter, J. G. Add. 1784.1.

S. salvelinus, Saibling. — Var. *profundus*. Fuhrmann, O. 1903.3,5. — Identification of the Linnæan, *Salmo salvelinus*. Heckel, J. J. 1851.1. — Misc. Schrank, F. P. & Wartmann, B. 1780.1, 1781.1; Wanger, C. 1896.1; Wispauer, J. 1880.1.

S. umbla. Ombre-chevalier or Röthel of Bodensee. — Systematic acc't. Rapp, W. L. 1854.1. — Misc. papers on natural history, distribution, etc. Bruyant, C. 1893.1, 1910.2; Delachaux, T. 1896.1; Hartmann, G. L. 1806.1; Perrier, L. 1899.1; Raveret-Wattel, C. 1896.1; Wanger, C. 1896.1; Wartmann, B. 1783.1; Lunel, G. Add. 1888.1.

MISCELLANEOUS PAPERS

On Salmon and Trout

Papers on breeding habits, natural history, reproduction, etc., chiefly relating to the salmon in Europe.

Text in Danish or Norwegian.

★Dahl, K. 1902.1,2, 1906.3, 1910.1; Feddersen, A. F. 1898.2, 1900.1; Grieg, J. A. 1896.2; Hansen, A. M. 1873.1; Hetting, M. G. 1874.1; Huitsfeldt-Kaas, H. 1903.1, 1904.1, 1905.1; Johansen, A. C. 1913.1; Nordgaard, O. 1896.1, 1897.2;

Olavsen, O. 1786.1; Porsild, M. P. 1910.1; Prenthun, J. 1905.1; Rasch, H. H. 1867.2, 1873.1, 1880.1; Dannevig, A. Add. 1914.1.

Text in Dutch. Harting, P. 1862.1, 1870.2; Hjort, J. 1901.5; ★Hoek, P. P. 1891.4, 1894.2, 4, 1897.1, 1909.2; Redeke, H. C. & Liebert, F. 1913.1; Vonk, C. 1832.1; Widegren, H. 1863.3.

Text in English. *Chiefly relating to salmon in the British Isles.* Anderson, (Rev.) J. 1883.1; Andrews, W. 1864.2, 1865.1; Atkinson, G. C. 1867.1; Badham, (Rev.) C. D. 1853.2; Christy, R. M. 1899.1; Cornish, T. 1883.4; Couch, J. 1859.1, 1860.1; Davy, J. 1863.2; Dawson, G. H. 1868.1; Day, F. 1880.12; Ellis, D. 1828.1; Harting, J. E. 1880.2; Knox, R. 1832.1-1856.1; Loch, J. 1837.1; Marshall, T. A. 1869.1; Morrison, A. 1803.1; Russel, A. 1864.1, 2; Smith, A. 1887.1; Smith, John A. 1878.1; Speedy, T. 1896.2; Day, G. M. Add. 1892.1.

Text in French. Bénardeau, F. 1905.1; Berthoule, A. 1888.1; Berthoule, A. & Vaillant, L. 1889.1; Boulangé, R. 1869.1; Bruyant, C. 1898.1; Cannieu, A. 1891.1; Cloquet, J. G. 1859.1; Ferris, — 1782.1; Hoek, P. P. 1891.4, 1896.2; Joly de Saily, — 1901.1; Jourdeuil, E. 1872.1; Künstler, J. 1889.1, 1890.1; Marcaillou-d'Ayméric, H. 1899.1, 2; Paulze d'Ivoy de la Poype, — 1901.1; Perrier, L. 1902.1; Petit, G. (*Gen. treat.*) 1897.1; Pouzols, A. 1910.1; Rollinat, R. 1913.1; ★Roule, L. 1906.1, 1912.3, 1913.1, 7, 1914.3, 4; Siccard, A. 1865.1; Vacher, — 1892.1; Haller, A. Pre-Linn. 1753.1.

Text in German. *Lachs oder Salm.* Bach, M. 1868.2; Barfurth, D. 1874.1, 1884.1, 1886.1, 2; Behr, S. [n. d.]; Bencke, B. 1886.1; Bieler, G. A. 1880.1, 1903.1; Boem, — 1900.1; Dankler, M. 1899.1; Ehrenbaum, E. 1895.2; Francis, F. 1873.1; ★Fritsch, A. J. 1871.2, 1894.1; Grotrian, — 1901.1; Heintz, K. 1910.1; Hoek, P. P. 1901.1, 1906.1; Holland, T. 1878.1; Krauss, F. 1865.1; Lehner, G. 1893.1; Lehner, H. 1895.1; Leonhardt, E. E. 1905.16; Lönnberg, A. J. 1896.5; Mayer, J. 1791.1; Metzger, A. 1879.2; Meyer, H. 1906.1; ★Miescher-Ruesch, F. 1879.1-1881.1, Add. 1897.1; Nilsson, S. 1849.1; Nüsslin, O. 1908.3; Savoie-Petitpierre, — 1909.1; Schieber, C. 1872.1; Schneider, G. 1908.6; Seidlitz, G. 1877.1; Seligo, A. 1894.1, 1896.3; Stender, E. 1912.1; Trybom, F. 1905.1; Zschokke, F. 1905.1; Anon. 108, 109, 179, 372, 480, 482; Grant, W. Pre-Linn. 1752.1; Haller, A. Pre-Linn. 1752.1.

Forelle, Bachforelle, Meerforelle, u. s. w. Agassiz, J. L. 1850.10; Ahlers, C. 1900.1; Braess, M. 1910.1; Bruttan, — 1888.1; Fitzinger, L. J. 1876.1; Heckel, J. J. 1852.2; Klunzinger, C. B. 1885.1, 1907.1; Liebe, C. 1875.1; Löns, H. 1908.2, 1912.1; Martell, P. 1916.1; Schmid, R. 1876.1; Schneider, M. 1898.1; Schubart, A. 1910.1; Schüz, E. 1866.1; Sprenger, W.

1901.3; Wartmann, B. (*S. illanca*) 1783.4; Zur Mühlen, M. 1911.5.

Text in Hungarian. Kohaut, R. 1906.1; Pelech, E. J. 1879.1.

Text in Japanese. Kitahara, T. 1905.1; Koshida, T. 1910.1; Tanaka, S. 1904.3; Kurita, M. Add. 1886.2.

Text in Latin. Fabricius, O. 1780.1; Gùldenstadt, A. J. (*S. leucichthys*) 1771.1; Ozeretskovski, N. 1801.1; Zäringer, J. B. 1829.1. — *Pre-Linn. references.* Ausonius, D. M. (*First description*) 1580.1; Bonge, D. 1642.1, 1730.1; Gronovius, J. F. 1741.2; O., D. C. 1703.2; Peyer, J. C. 1683.1, 1750.1.

Text in Russian. Arsenjev, V. 1909.1; Baženov, A. 1905.2; Berg, L. S. 1908.5, 6, 7; Heide, E. J. 1911.1, 1912.2; Soldatov, V. K. 1912.1, 2; Emeljanenko, N. Add. 1913.1.

Text in Swedish. Genetz, A. T. 1899.1; Hardin, S. 1862.1; Hellenius, C. N. 1785.1; Hintze, A. 1886.1-1900.1; Holmberg, H. J. 1864.1; Lagus, S. 1900.1; Landmark, A. 1909.1; Lönnberg, A. J. 1897.4, 1898.1, 1899.1; Lundberg, R. 1901.1; Malmgren, A. J. 1869.5; Mortensen, O. T. 1900.1; Nordmann, A. 1857.1; Nordqvist, O. F. 1894.2, 1895.4, 5, 1900.3, 9, 1906.3; ★Nordqvist, O. F., Ekman, T. & Schmidt, C. 1911.1; Oleen, B. O. 1871.1; Palmén, J. A. 1910.1; Sandman, J. A. 1907.2, 3; ★Smitt, F. A. 1886.1; Stenbäck, J. 1898.1; Svinhufvud, S. 1893.1; Tammelaender, K. 1903.1; Thesleff, E. 1893.1; ★Widegren, H. 1863.1, 1865.2; Haller, A. Pre-Linn. 1752.2.

Sub-family Coregoninae

The whitefishes

Revisions, American species. Bean, T. H. 1884.10; Evermann, B. W. & Smith, H. M. 1896.1. — *Great Lakes.* ★Jordan, D. S. & Evermann, B. W. 1911.1.

Whitefishes of — German and Swiss lakes, chiefly Lake of Constance. Fatio, V. 1884.1, 2, 1885.1, 2, 1896.1-1902.1, Add. 1885.1; Klunzinger, C. B. 1884.2; Krebs, W. 1904.1; Lochner von Hüttenbach, — 1904.1; Nüsslin, O. 1882.1, 2, 1884.1, 1903.2. — *Lake Onega, Russia.* Mikhailovskii, M. M. 1903.2. — *Loch Lomond, Scotland; taxonomy.* Parnell, R. 1838.2.

Argyrosomus (Cisco). *Occurrence in — Lake Tippecanoe, Indiana.* Jordan, D. S. 1875.1. — *Indiana lakes.* Lower, W. I. Add. 1913.1.

Economic importance. Wagner, G. 1908.2, 1909.1.

Coregonus (Whitefish). *Occurrence — in northern Germany.* Einfeld, H. 1880.1; Seligo, A. 1894.2. — *in Lake of Constance.* Klunzinger, C. B. 1903.1, 1904.1, 1905.1; Nüsslin, O. 1901.1, 2, 1903.1, 1904.1, 1905.1. — *in Wätsaari district, Finland.* Nordqvist, O. F. 1897.6. — *in Ticino, Switzerland.* Pavesi, P. 1898.1. — *in New York.* Smith, H. M. 1895.3. — *in Lake Peipus, Russia.* Zur Mühlen, M. 1911.27.

For a map showing the geographical distribution of the genus *Coregonus*, see Meek, A. 1916.1 (p. 136).

Natural history, European forms, chiefly in Lake of Constance. Besana, G. 1900.1; Bloch, M. E. 1779.1; Dröscher, W. 1907.1; Ericsson, B. 1905.1; Goll, H. 1882.1, 1883.1, 1892.2; Grube, A. E. 1878.1; Hofer, B. (*Ammensee, Bavaria*) 1908.2; Maier, H. N. 1910.1; Nordqvist, O. F. 1897.3; Nüsslin, O. 1903.2, 1907.1, .2, .3, 1908.1, 1910.1; Schwarz, J. 1911.2; Schillinger, A. 1896.1; Schweizer, W. 1894.1, 1916.1; Siebold, C. T. E. 1858.1; Sjöberg, H. R. A. 1897.2; Wartmann, B. 1777.2; Zur Mühlen, M. 1911.21; Anon. 273, 613.

Natural history, British and American species. Embleton, D. 1877.1; Fowler, H. W. 1905.2; Francis, F. 1878.2; Knox, R. 1834.1; Ward, H. B. 1896.2; Hankinson, T. L. (*Young*) Add. 1914.2; Lydekker, R. Add. 1906.5.

Taxonomy, British and Irish species; revision. Regan, C. T. 1908.18.

Variations. — *Variability in Lake Erie.* Putnam, F. W. 1866.2. — *C. fera*, originally from *Bodensee*, giving rise to *C. fera sancti-benedicti*, n. var. in *Laachersee, Prussia*, after 40 years' isolation. Thienemann, A. 1911.2, 1912.5, 1914.1.

Sub-family Thymallinæ

Taxonomy. Gill, T. N. 1895.1, Add. 1896.1.

Thymallus (Grayling). *Distribution.* Goode, G. B. & Bean, T. H. 1879.13. — *For map showing the geographical distribution, see Meek, A. 1916.1 (p. 137).*

Natural history notes, popular articles, etc. Berg, L. S. 1908.8; Bissell, J. H. 1893.2; Bullock, W. J. 1879.1; Dean, H. D. 1913.1; Evermann, B. W. 1905.14, 1906.8; Fatio, V. 1902.1; ★Henshall, J. A. 1899.1; ★Hofer, J. 1895.1; ★Hutchinson, H. G. 1904.1; Norris, T. 1879.12; Parker, J. C. 1889.2; Raveret-Wattel, C. 1889.2; Watkins, M. G. 1896.2; Whitaker, H. 1887.1; Calderwood, W. L. Add. 1891.1; Day, G. M. Add. 1892.1; Norris, T. Add. 1883.1; Helwing, G. Pre-Linn. 1718.1.

Taxonomy, review, North American forms. Milner, J. W. 1874.3.

Thymallus vexillifer, general account. Warnimont, J. 1870.1.

Sub-family Argentininæ

For a map showing geographical distribution, see Meek, A. 1916.1 (p. 141).

Taxonomy. — *Synopsis of genera.* Gill, T. N. 1863.18. — *Review, Japanese forms.* Jordan, D. S. & Snyder, J. O. 1902.6.

Argentina. *Natural history.* Fulton, T. W. 1901.1; Nozeman, C. Pre-Linn. 1758.1.

Occurrence in — *Scotland.* Edwards, T. 1881.1; Peach, C. W. 1859.2. — *Sable I. Bank, off Nova Scotia.* Goode, G. B. & Bean, T. H. 1878.2. — *Great Britain.* Holt, E. W. L. 1897.2. — *New Zealand.*

Hutton, F. W. 1879.1. — *Japan.* Kishinouye, K. 1904.2.

For a map showing the geographical distribution of the genus *Argentina*, see Meek, A. 1916.1 (p. 144).

Hypomesus (Surf Smelt). *Popular account, with fishing methods of the Quillehute Indians, west coast of Washington (state).* Swan, J. G. 1880.1.

Mallotus (Capelin). *Natural history.* Cormack, W. E. 1826.1; Jones, J. M. 1878.1; Hardy, C. 1867.1.

Fossil forms. — *Petrifaction in Iceland.* Agassiz, J. L. 1848.8. — *In Pleistocene nodules of Green's Creek, Ottawa.* Dawson, J. W. 1890.1.

Osmerus (Smelt). *Fisheries.* — in *Russia.* Ergomysev, N. 1910.1; Samsonov, N. A. (*Livonia*) 1910.1. — in the *Netherlands.* Redeke, H. C. 1914.3. — in *Norfolk, England.* Southwell, T. 1884.1, .3.

Natural history notes, habitat, occurrence, etc. Coward, T. A. 1912.1; Duméril, A. H. 1866.4; ★Ehrenbaum, E. 1896.1; Feddersen, A. F. 1870.3; Herbert, H. W. 1882.1; Jordan, D. S. 1878.4; Kuchin, I. B. (*Ilmen Lake*) 1903.1; Noël de la Morinière, S. 1798.1; ★Nordqvist, O. F. 1910.6; Norris, T. 1862.2, 1874.8; Rice, H. J. 1878.3; Schneider, G. 1902.4; Ordway, J. P. Add. 1875.1. — *O. arcticus; practical and scientific investigations in Finmark.* ★Sars, G. O. 1879.3, 1883.1.

Taxonomy, Review of California species. Fisk, M. 1913.1.

Thaleichthys (Eulachon or Candlefish). *Natural history.* Brown, Robert 1868.1; Redwood, T. 1880.1; Scudder, C. W. 1878.2; Swan, J. G. 1882.1; Anon. 318, 524.

Sub-family Microstominæ

Taxonomy. Gill, T. N. 1865.7.

Sub-family Salanginæ

Taxonomy, Japanese species. Jordan, D. S. & Snyder, J. O. (review) 1902.6; Wakiya, Y. & Takahashi, M. 1913.1. — *Synopsis.* Regan, C. T. 1908.20.

Family Stomiatiidæ

Taxonomy. — *Ireland.* Holt, E. W. & Byrne, L. W. 1913.1. — *Arctic regions.* Lütken, C. F. 1876.1, 1877.2. — *Synopsis.* Lütken, C. F. 1892.1. — *Key to genera.* Zugmayer, E. 1913.2.

Chauliodus. *Occurrence* — *On Spanish coast.* Odón de Buen, D. 1902.1. — *On Georges Banks, Newfoundland.* Putnam, F. W. 1874.7.

Taxonomy. Bleeker, P. 1862.1.

Maurolicus. *Description of specimen taken in Gulf of Genoa.* Damiani, G. 1896.5.

Sub-family Sternoptychinæ

Taxonomy. — *Mediterranean forms.* Damiani, G. 1896.5. — *Taxonomy and synonymy.* Gill, T. N. 1885.2. — *Irish waters.* Holt, E. W. L. & Byrne, L. W. 1913.1. — *Arctic regions.* Lütken, C. F. 1876.1, 1877.2. — *Synopsis.* Lütken, C. F. 1892.1.

Family Gonorhynchidæ

Taxonomy, fossil forms; Eocene. Cope, E. D. 1885.1, 1886.2; Woodward, A. S. 1896.4.

SUB-ORDER OSTARIOPHYSI

Taxonomy. — *Eventognathi* (*Catostomidæ*, *Cobitidæ*, *Cyprinidæ*). Gill, T. N. 1862.14. — *Cyprinoidea* (*Characiformes*, *Gymnotiformes*, and *Cypriniformes*). Regan, C. T. 1911.5. — *Revision; African species.* Boulenger, G. A. Add. 1909.1. — *Fossil forms.* Woodward, A. S. 1889.2.

Family Characinidæ

For maps showing the geographical distribution of the Characinidæ, see Boulenger, G. A. 1904.7 (p. 576), and Meek, A. 1916.1 (p. 172).

Taxonomy, general treatises, reviews, and synopses. Kner, R. 1859.2; Müller, J. & Troschel, F. H. 1844.1, 1845.1; Reinhardt, J. T. 1866.1; Steindachner, F. & Kner, R. 1859.1. — *Annotated list of specimens in U. S. Nat. Mus.* Eigenmann, C. H. & Ogle, F. 1907.1. — *Species in Philad. Acad.* Fowler, H. W. 1906.4. — *South American species.* Eigenmann, C. H. 1907.1; Lütken, C. F. 1874.1, 1875.1; Ulrey, A. B. (Brazilian) 1895.1; Steindachner, F. (Amazonian) 1876.1, 1877.1. — *Differential characters of Characinoids and Erythrinoids.* Gill, T. N. 1896.1. — *Revision of the genera Chalceus, Copeina, Pogonocharax, and Pyrrhulina.* Regan, C. T. 1912.20. — *Revision; African species.* Boulenger, G. A. Add. 1909.1.

Fossil. — *Onchosaurus* of Cretaceous considered ancestral form. Eastman, C. R. Add. 1917.1.

Sub-family Erythrininæ

Taxonomy; review. Eigenmann, C. H. & R. S. 1889.9.

Sub-family Hydrocyoninæ

Alestes. *List of species.* Boulenger, G. A. 1901.13.

Chirodon. — *Taxonomic revision of South American species of Chirodon and related forms.* ★Eigenmann, C. H. 1915.1. — *Synopsis.* Ulrey, A. B. 1895.1.

Megalobrycon. *Taxonomy; revision.* Ribeiro, A. de M. 1905.1.

Tetragonopterus and allied forms. *Taxonomy* — *Guiana.* Durbin, M. L. 1909.1. — *Brazil.* Eigenmann, C. H. 1908.1, 1911.3.

Nomenclature. Gill, T. N. 1896.6.

Sub-family Serrasalmoninæ

Piranhas or Caribas

For Serrasalmoninæ attacking men, see under Predatory Fishes.

South American species. Eigenmann, C. H. 1915.2. — *Habits and modes of capturing.* Paez, R. 1862.1. — *Popular account.* Winkler, T. C. 1858.1.

Sub-family Distichodontinæ

Distichodus. *List of species.* Boulenger, G. A. 1901.14.

Sub-family Citharininæ

Curimatus and allied forms. *Taxonomy; revision.* Eigenmann, C. H. & R. S. 1889.10.

Family Gymnotidæ

For a map showing the distribution of the Gymnotidæ, see Meek, A. 1916.1 (p. 172).

Taxonomy. — *Revision.* Eigenmann, C. H. & Ward, D. P. 1905.1. — *Monograph.* ★Ellis, M. M. 1913.1. — *Place in system.* Fritsch, G. T. 1878.1. — *Synopsis.* Kaup, J. J. 1856.7. — *Argentine species.* Lahille, F. 1910.2. — *Species in Vienna Museum.* Steindachner, F. 1868.1. — *Amazonian forms.* Wallace, A. R. 1853.1.

Phylogeny and manner of life. Schlesinger, G. 1910.1.

Gymnotus (*Electric Eel*). *Natural history, descriptions, mode of capture, etc.* Bajon, — 1774.1, 1779.1; Broussonet, P. M. 1782.2; Bryant, W. 1786.1; Fahlberg, S. 1801.1; Flagg, H. C. 1786.1; Fritsch, G. T. 1879.1; Garden, A. 1775.1; Guisan, F. L. 1797.1, 1819.1; Harting, P. 1880.5; ★Humboldt, F. & Bonpland, A. 1805.1, 1820.1; Hunter, J. 1775.1; Janin de St. Just, — 1821.1; Linden, C. 1879.1; Lindes, L. 1880.1; Musschenbroeck, P. 1760.1; Paez, R. 1863.1; Quelch, J. J. 1897.1; Samo, J. 1837.1; Anon. 186; Gronovius, L. T. Add. 1758.1; Schilling, G. W. Add. 1769.1, Add. 1770.2.

Natural history accounts in Pre-Linnæan section. Acuña, C. 1758.1; Allamand, J. N. 1756.1; Berkel, A. 1693.1; Richer, J. 1729.1; Sundius, P. 1748.1; Warren, G. 1667.1.

For anatomy and functions of electrical organs, see under Electrical Fishes.

Family Cyprinidæ

For a map showing the geographical distribution of the Cyprinidæ, see Meek, A. 1916.1 (p. 172).

For all hybrid forms, see under Hybrids.

Natural history. Leonhardt, E. E. 1903.3; Neydeck, K. J. 1848.1.

Nomenclature. Bleeker, P. 1863.14.

Taxonomy, affinities, and distribution. Agassiz, J. L. 1835.7, 8; ★Gill, T. N. 1907.1, 4; Heckel, J. J. 1836.1.

Taxonomy of African species; revision. Boulenger, G. A. Add. 1909.1.

Taxonomy of Cyprinidæ in Asia. — *Ceylon.* Bleeker, P. 1863.2. — *China.* Bleeker, P. 1871.2, 1872.1. — *Dutch East Indies.* ★Bleeker, P. 1860.2, 1860.10, 1862.1, 1863.30. — *India.* ★Day, F. 1871.1; M'Clelland, J. 1839.1, 2; Storer, D. H. 1841.1. — *Syria.* Heckel, J. J. 1843.1. — *Japan.* Jordan, D. S. & Fowler, H. W. 1903.4. — *Caucasia.* Kamenskii, S. N. 1899.1. — *Persia.* Keyserling, E. 1861.1.

Taxonomy of Cyprinidæ in Europe. Bonaparte, C. L. 1845.1, 3; ★Dybowski, B. I. 1864.1; Fitzinger, L. J. 1874.1, 2; Heckel, J. J. 1836.3. — *Switzerland.* Agassiz, J. L. 1834.2; Fatio, V. 1876.2, 1877.2. — *France.* Quincy, C. 1910.1.

Taxonomy of Cyprinidae in North America. Jordan, D. S. 1877.1, 1886.1. — *New Jersey.* Abbott, C. C. 1874.4. — *Pennsylvania.* Cope, E. D. 1869.4; ★Fowler, H. W. 1908.3. — *Researches upon the cyprinoid fishes inhabiting the fresh-water west of the Mississippi Valley.* Girard, C. F. 1857.7.

Sub-family Catostominae

Taxonomy, North America. Agassiz, J. L. 1855.1; Fowler, H. W. 1914.6; Jordan, D. S. 1878.12, 1886.1.

Sub-family Cyprininae

Abramis (Bream). *Natural history and occurrence.* Bücker, F. 1869.1; Gunn, T. E. 1879.2; Keene, J. H. 1879.5; Lönnberg, A. J. 1903.8; Mela, A. J. 1883.3. — *in Bavaria.* Surbeck, G. 1908.4. — *in Austria.* Rozwadowski, J. 1902.1.

Alburnus (Bleak). *Natural history and occurrence.* Deyrolle, T. 1871.1; Gatti, M. A. (Italy) 1897.1; Keene, J. H. 1879.5; Anon. 201. — *In Caucasia.* Grünberg, V. Add. 1914.1.

Taxonomy, Caucasia. Kavraiskii, T. T. 1897.1.

For the use, in the manufacture of artificial pearls, of guanin from the scales of the bleak, see Economic Products, under Fisheries.

Barbus. *Natural history, occurrence (in Europe), etc.* Clément, C. 1875.1; Forel, F. A. 1906.1; Günther, A. C. 1872.4; Herrmann, W. 1904.1; Hitz, — 1894.1; Mourgue, M. 1901.1; Olivier, E. 1914.1; Stansch, K. 1904.1; Witthalm, L. 1880.1; Anon. 83. — *In Switzerland.* ★Hofer, J. 1895.2. — *In Silesia.* Knauth, K. 1890.2. — *Alps of Dauphiné.* Légar, L. 1910.4.

Carassius (Gold-fish). *Natural history notes.* Boeck, G. 1875.2; Bullen, G. E. 1909.1; Charvet, P. A. 1826.1; Pap, J. 1871.1; Anon. 315, 563; Le Comte, L. Pre-Linn. 1698.1; Linnæus, C. Pre-Linn. 1740.2. — *Telescope variety.* Carbonnier, P. 1872.2, 3, 1873.3.

Goldfish culture

General treatises on goldfish culture in ponds and in aquaria. ★Bade, E. 1900.1; Chaine, J. 1899.1; Mulertt, H. 1892.1, 1902.1; Reed, C. A. 1908.1; ★Smith, H. M. 1909.2; Sauvigny, E. L. 1780.1; ★Stansch, K. 1910.6; Wolff, H. T. 1909.1.

Origin of races. Tornier, G. 1908.2; Schaeck, H. E. 1893.1.

Pond culture, shorter papers. — *in Japan.* Kishinouye, K. 1898.2; Laackmann, H. 1912.1, 2; Leonhardt, E. E. 1906.7; Matsubara, S. 1908.1. — *in China.* Kreyenberg, M. 1911.1. — *in Germany.* Milewski, A. 1914.6; Revoil, C. 1891.1; Walter, E. 1906.1; Wagner, C. Add. 1879.1.

Culture of goldfish in aquaria, shorter papers. Blanchon, H. L. 1912.1, Add. 1899.1; Griesse, A. 1901.1; Hennig, E. 1904.1; Heron, R. 1842.1; Kammerer, P. 1909.2; Leonhardt, E. E. 1912.1; Lloyd, S. C. 1912.1; Milewski, A. 1910.1,

1912.2, 3; Peyrl, T. 1910.1; Reitmayer, C. A. 1914.2; Ringel, E. 1901.1; Ryder, J. A. 1884.1; Schreitmüller, W. 1912.18, 1913.2; Sprenger, W. 1900.7.

Culture of Lion-head variety. Laackmann, H. 1911.1; Thumm, J. 1911.1.

Culture of Telescope variety. Carbonnier, P. 1872.2, 3, 1873.3; Delaval, A. 1899.1, 1903.1; Depp, N. 1894.1; Frank, F. 1880.1; Langer, — 1877.1; Lee, H. 1875.1; Newman, E. 1875.1; Nitsche, P. 1892.1; Noll, F. C. 1878.1; Sasse, A. 1878.1; Schreitmüller, W. 1912.14, 18, 1913.2.

Chondrostoma. *Occurrence, natural history, etc.* Cockerell, T. D. 1910.1. — *In Teramo, Italy.* Gatti, M. A. 1896.1. — *France.* La Blanchère, P. R. 1872.5, 1873.1; Pellegrin, J. (Loire R.) 1900.2; Roule, L. 1902.5; Zur Mühlen, M. 1911.10. — *Austria.* Heckel, J. J. 1851.1; Rozwadowski, J. 1903.1.

Fossil species. — *Miocene of Baden.* Winkler, T. C. 1861.1.

Cyprinus (Carp). *General treatise.* Supino, F. 1911.1.

Natural history notes, popular articles, etc. Cole, L. J. 1905.1, 1906.1; Dieulafoy, L. & Bruyant, C. 1904.1; Distant, W. L. 1904.2; Ekström, C. U. 1838.1; Feddersen, A. F. 1898.1; Forel, F. A. 1899.1; Halkett, A. 1907.2; Hunt, W. T. 1912.1; ★Hutchins, D. E. 1906.1; Keene, J. H. 1879.5; Lankester, E. R. 1870.1; La Tourrette, M. 1775.1; McGovern, H. D. 1882.1, 1883.1; Meier, H. 1864.1; Schirmer, — 1901.1; Zürn, E. S. 1900.1; Krauss, C. F. Add. 1890.1.

Natural history notes in Pre-Linnæan section. Ledel, S. 1692.1; Linnæus, C. 1744.1; Needham, W. 1720.1; Nozeman, C. 1757.1.

Value as food. Bartlett, S. P. 1901.1–1912.1.

Growth and size. Hessel, R. 1880.2; Heyser, E. 1883.1; Johnson, S. M. 1883.1; Mather, F. 1881.1.

Races and varieties. Hofer, B. 1898.1; Gartner, F. 1898.1; Roberts, A. W. 1880.3; Russell, A. J. 1873.1; Zentz, F. 1882.1.

Fossil in — *Jurassic of Württemberg.* Bronn, H. G. 1830.1. — *Tertiary; taxonomy.* Münster, G. 1836.1.

Diptychus. *Natural history.* Anikin, V. P. 1906.1.

Gobio. *Natural history notes.* Berg, L. S. 1907.8; Mäklin, F. W. 1871.1; Mela, A. J. G. 1886.2.

Labeo. *African species with diagnostic key.* Boulenger, G. A. 1903.12.

Leucaspis. *Natural history and occurrence.* — *in Sweden.* Lilljeborg, W. 1872.1. — *in Hungary.* Vutskits, G. 1903.1.

Leuciscus (Rudd or Red-eye). — *Popular general treatise.* Fennell, J. G. 1870.1. — *Fisheries; Switzerland.* Hofer, J. 1897.1.

Natural history and occurrence. Baird, S. F. 1874.17; Bonaparte, C. L. 1845.5; Chearney, R. 1875.1; Chiappi, T.

1903.1; Corbin, G. B. 1906.1; Hofer, J. 1911.5; Keene, J. H. 1879.5; Kirsch, D. W. 1880.1; Lupton, F. 1878.1; Milde, C. J. 1873.1; Solger, B. F. 1878.1; Warnimont, J. 1865.1.

Taxonomy and nomenclature. Bonaparte, C. L. 1840.1, 1844.1. — *Nomenclature.* Cockerell, T. D. 1909.2.

Fossil forms. — *Miocene, Nevada.* Lucas, F. A. 1900.1, 1901.1. — *Sweden.* Sernander, R. 1902.1. — *Oligocene, Germany.* Troeschel, F. H. 1854.1. — *Miocene of Baden.* Winkler, T. C. 1861.1. — *Triassic.* Zenker, — 1883.1.

Notropis (*Horned Dace*). *Classification and nomenclature.* Cockerell, T. D. & Callaway, O. 1909.2; Fowler, H. W. 1910.8.

Natural history. Embury, G. C. Add. 1914.2.

Oreoleuciscus. *Taxonomy, monograph.* Varpakhovskii, N. A. 1889.2.

Pimephales. *Taxonomy; review.* Bicknell, E. P. & Dresslar, F. B. Add. 1885.1.

Phoxinus. *Natural history accounts, descriptions, etc.* Bertrand, Emile 1889.1; Blanchard, R. 1896.1; Bucek, L. 1880.1; Leydig, F. 1892.3; Troeschel, F. H. 1851.1, 1872.1; ★Warnimont, J. 1867.1. — *Notes on Palæarctic species.* Berg, L. S. 1907.7.

Rutilus. *Taxonomy and nomenclature.* Cockerell, T. D. 1909.2; Fowler, H. W. 1914.10.

Semotilus (*Wind-fish or Fall-fish*). *Natural history notes.* Evermann, B. W. 1905.6; Griggs, J. W. 1878.1; Robinson, R. E. 1878.1; Sicklen, G. W. 1878.1. — *Illustration.* *S. atromaculatus.* Agassiz, J. L. & Baird, S. 1889.1.

Tinca (*Tench*). *Natural history.* Belloc, E. 1901.1; Harting, P. 1875.3; Witthalm, L. 1880.1.

Fossil forms from Miocene — of *Württemberg.* Fraas, O. Add. 1870.1. — of *Baden.* Winkler, T. C. 1861.1.

Rhodeus (*Bitterling*). *Natural history notes and descriptions (chiefly Swiss forms).* Berg, C. 1880.1; Fatio, V. 1905.2; Fischer-Sigwart, H. 1910.1; Hofer, J. 1910.1; Richters, F. 1901.1.

Taxonomy. — *Synopsis.* Berg, L. S. 1907.3. — *Amur basin forms.* Berg, L. S. 1907.9. — *Fossil forms.* Winkler, T. C. 1861.1.

• *For incubation of eggs in gill-cavities of mussels, see Parental Care, under Reproduction.*

Sub-family Cobitidinae

Taxonomy. Bleeker, P. 1863.23. — *Amur basin.* Berg, L. S. 1907.11. — *Ceylon.* Bleeker, P. 1864.2. — *Japan.* Jordan, D. S. & Fowler, H. W. 1903.3.

Occurrence as fossils in Idaho. Cope, E. D. 1872.10.

Cobitis (**Misgurnus**) (*Loach*). *Natural history, occurrence, etc.* Cederström, G. C. (Sweden) 1874.1; Du Rondeau, F. 1783.1; Faulds, H. 1878.1; Filippi, F. (Italy)

1859.1; Jeitteles, L. H. (Hungary) 1861.2; Maillard, L. 1900.1; Palmén, J. A. (Finland) 1881.2, 3; Struck, C. 1869.1; Troeschel, F. H. (German mountain brooks) 1851.1, 1872.1; Anon. 336; Gronovius, J. F. Add. 1775.1, Pre-Linn. 1748.1; Martini, F. H. Add. 1774.2.

For Cobitis as a weather prophet see under Behavior.

Fossil forms in Germany. — *Tertiary.* Meyer, C. E. H. 1851.2. — *Miocene.* Winkler, T. C. 1861.1.

Nemachilus. *Central Asiatic forms; synopsis.* Herzenstein, S. M. 1888.1.

Family Siluridae

Distribution of Siluridae in time and space. Vaillant, L. L. 1897.2.

Natural history, popular account. North America. Kendall, W. C. 1910.1.

Taxonomy. Bleeker, P. 1863.31; Carriuccio, A. 1903.1. — *Java.* Bleeker, P. 1846.1, 2, 1847.2, 3, 4. — *Dutch East Indies.* Bleeker, P. 1858.8, 1862.1. — *Surinam.* Bleeker, P. 1862.3, 1864.3. — *India and Burmah (Fresh water).* Day, F. 1871.5, 1876.1. — *Synopsis, United States (Fresh-water).* Jordan, D. S. 1877.4. — *Japan (Review).* Jordan, D. S. & Fowler, H. W. 1903.6. — *Central America (Review).* Jordan, D. S. & Gilbert, C. H. 1883.24. — *Brazil.* Kner, R. 1858.1, 2. — *South America.* Lütken, C. F. 1874.1, 4. — *Madagascar.* Vaillant, L. L. 1894.2. — *Borneo.* Vinciguerra, D. 1879.1. — *Revision, African species.* Boulenger, G. A. Add. 1909.1.

Fossil forms. Leriche, M. 1901.1, 1908.3. — *Tertiary, Bohemia.* Laube, G. C. 1897.1. — *In Eocene of Paris basin.* Priem, F. 1904.3.

Sub-family Clariinae

Taxonomic revision, African species. Boulenger, G. A. 1908.9.

Sub-family Silurinae

Silurus glanis (*the Wels*). *Natural history and occurrence in Central Europe.* Feddersen, A. F. 1896.2; Fougereux de Bondaroy, — 1784.1; Hofer, B. 1906.1; Hofer, J. 1896.2; Holm, T. 1779.1; Lubach, D. 1852.1, 1864.1; Lühe, M. 1909.1, 1912.1; Meier, H. 1865.2; Malmgren, A. J. 1888.1; Mela, A. J. 1883.2; Plant, J. 1878.1, 1879.1, 2; Reinhardt, J. T. 1865.1; Spohrer, — 1897.1; Winkler, T. C. 1871.3; Anon. 194, 627; Imhof, O. E. Add. 1892.1.

Parasilurus (*the Glanis of the Greeks and Romans*). *Natural history.* Apostolides, N. C. 1883.1, 1892.1; Bleeker, P. 1862.6; ★Gill, T. N. 1906.4; Houghton, W. 1873.1; Garman, S. Add. 1891.3; Manardi, G. Pre-Linn. 1560.1.

Sub-family Bagrinae

Arius. *Fossil forms in Tertiary of Siwaliks.* Günther, A. C. 1881.3. — *in Eocene of France.* Priem, F. 1904.3. — *in Eocene of Belgium.* Smets, G. Add. 1886.1.

Amiurus (*Bull-head*). *Natural history.* Berthier, V. 1905.1; Dean, B. 1891.1;

Good, A. 1902.1; Lamarche, C. 1904.1; Leonhardt, E. E. 1905.25.

Ictalurus (*Spotted Cat-fish*). *Natural history*. Jordan, D. S. 1885.3.

Liocassis. *Taxonomy; synopsis*. Regan, C. T. 1913.22.

Noturus (*Stone Cat-fish*). *Taxonomy; review*. Swain, J. & Kalb, G. B. 1882.1.

Pimelodus. *Taxonomy; synopsis*. Gill, T. N. 1862.23.

Sub-family Doradinae

Taxonomy. — *African species*. Boulenger, G. A. 1900.14. — *Brazilian species*. Ribeiro, A. 1912.1; Steindachner, F. 1875.4.

Exostoma. *Taxonomy; synopsis*. Regan, C. T. 1905.17.

Synodontis. *Taxonomy; monograph*. ★Vaillant, L. L. 1895.1.

Sub-family Malopterurinae

Malopterurus (*Electric Cat-fish*). *Natural history*. Forbes, H. O. 1897.3; Kammerer, P. 1906.1; Panceri, P. 1858.1; Peters, W. C. 1868.2; Rudolphi, C. A. 1824.1; Waddell, H. M. 1858.1; Broussonet, P. M. Add. 1787.1; Patterson, W. Add. 1786.1; Adanson, M. Pre-Linn. 1749.1; Ludolf, H. Pre-Linn. 1681.1.

History of discovery. Du Bois-Reymond, E. H. 1859.2.

Nomenclature. Gill, T. N. 1903.9.

For anatomy and functions of electrical organs, see under Electrical Fishes.

Sub-family Callichthyinae

Taxonomy. Ellis, M. L. 1913.1. — *Brazil*. Ribeiro, A. de M. 1912.1.

Corydoras. *Taxonomy; revision*. Regan, C. T. 1912.21.

Sub-family Trichomycterinae

Taxonomy; Brazil. Ribeiro, A. de M. 1912.1.

For parasitic habits of fishes of this sub-family, see under Parasitic Fishes.

Stegophilus. *Natural history and systematic position*. Rachow, A. 1913.5; ★Reinhardt, J. T. 1859.1.

Vandellia ("Candiru"). *Taxonomy; revision*. Pellegrin, J. 1909.12.

Family Loricariidae

Natural history. Weyenbergh, H. 1878.3.

Taxonomy. Eigenmann, C. H. 1905.3. — *Revision*. Kner, R. 1854.1, 2. — *Monographic revision*. ★Regan, C. T. 1904.6. — *Brazilian forms*. Ribeiro, A. de M. 1912.1.

Acanthicus. *Natural history*. Berg, C. 1901.1; Hagmann, G. 1901.1, 1902.1.

Arges. *Natural history of the "volcano fish" formerly called Cyclopius cyclopius, Eremophilus mutisii, and Pimelodus cyclopius*. Boussingault, J. B. 1864.1; Day, F. 1891.1; ★Evermann, B. W. & Kendall, W. C. 1905.1; Girard, C. F. 1889.1, Add. 1889.2; ★Humboldt, F. & Bonpland, A. 1805.1; Orton, J. 1871.1; Putnam, F.

W. 1871.3; Spicer, W. W. 1871.2; Wagner, M. 1870.2; Winkler, T. C. 1857.2; Humboldt, A. Add. 1823.1; Whymper, E. Add. 1892.1.

Taxonomy; revision. Evermann, B. W. & Kendall, W. C. 1905.1; Regan, C. T. 1905.18.

Family Aspredinidae

Taxonomy and relationships. Gill, T. N. 1891.3.

Group Nematognathi

This group, formerly given ordinal rank, embraces the Siluridae, Loricariidae, and Aspredinidae.

Taxonomy and relationships. Agassiz, J. L. R. 1868.1; Regan, C. T. 1911.6; Gill, T. N. Add. 1898.1. — *South American forms*. ★Eigenmann, C. H. & R. S. 1888.4, 5, 1889.3, 1890.3; Ihering, R. (Brazil) 1907.1; Kindle, E. M. (in Cornell Museum) 1895.1.

Evolution. Eigenmann, C. H. 1890.4.

Fossil forms from Eocene. Newton, E. T. 1889.1. — *Egypt*. Stromer, E. 1904.3.

SUB-ORDER SYMBRANCHII

For a map showing the geographical distribution of the Symbranchii, see Meek, A. 1916.1 (p. 166).

Taxonomy. Regan, C. T. 1912.1; Boulenger, G. A. (Revision, African species) Add. 1909.1.

Family Symbranchidae

Taxonomy, Indian Archipelago. Bleeker, P. 1853.4, 1862.1. — *General account*. Dareste, C. 1873.1, 2.

Monopterus. *Taxonomy; review, Japan*. Jordan, D. S. & Snyder, J. O. 1901.7.

SUB-ORDER APODES

Taxonomy; general works. Gill, T. N. 1910.1; Kaup, J. J. 1856.1; Regan, C. T. 1912.15. — *Review; America and Europe*. Jordan, D. S. & Davis, B. M. 1892.1. — *Review; Japan*. Jordan, D. S. & Snyder, J. O. 1901.7. — *Indian forms*. M'Clelland, J. 1845.1. — *African species*. Boulenger, G. A. Add. 1909.1. — *Fossil forms*. Woodward, A. S. 1889.2.

FAMILY ANGUILLIDAE

ANGUILLA

The Common or Fresh-water Eel

Including an account of the recent discoveries in its life history and reproduction.

The literature on the eel is relatively enormous, and the present account attempts to suggest the more important references, rather than to attempt to analyze them in detail.

"The problem of the propagation and breeding places of the Common or Fresh-water Eel is one of great antiquity; from the days of Aristotle naturalists have occupied themselves therewith, and in certain regions of Europe it has exercised popular imagination to a remarkable degree. It is only during the last three decades, however, that any real results have been attained." J. Schmidt in

"The Breeding Places of the Eel," Phil. Trans. Roy. Soc. London, 1922, ser. B., vol. 211, p. 179.

Principal literature

Our knowledge of the life history of the eel is largely due to the brilliant and extended researches of Dr. Johannes Schmidt of the Carlsberg Laboratory of Copenhagen (cited as Schmidt, E. J. 1906.1-1914.2). These papers are chiefly in English and have been embellished with excellent illustrations of all stages of development. These researches have been summarized in two general papers one of which is cited as ★Schmidt, E. J. 1906.1, and the other is the very recent paper, quoted above.

For a map showing the geographical distribution of the genus *Anguilla*, see Meek, A. 1916.1 (p. 158).

Life history of the Eel

Because of the very lateness of these discoveries, which have not yet entered fully into general ichthyological literature, we feel justified in giving the following somewhat extensive summary, compiled chiefly from the papers just mentioned (especially Schmidt, 1906.1).

The first *Leptocephalus* to come to the attention of naturalists seems to be the specimen taken by William Morris near Holyhead, England in 1763 and subsequently described by Gmelin (J. F. 1788.1, p. 1150) as *Leptocephalus morrisii*.

Subsequently numerous other specimens of these small, translucent or glassy, ribbon-like creatures, brought to the surface by the whirlpools in the Straits of Messina, came into the hands of naturalists and were known under the family name of *Leptocephalidae* (Bonaparte).

Carus (J. V. 1861.2), in considering these fishes, recognized their true nature as larval forms, and assumed that they were probably the larval form of the ribbon fishes (*Trachypteridae*). This conclusion was shown to be erroneous by Peters (W. 1869.2), who demonstrated that larval ribbon fishes were quite different.

Gill (T. N. 1865.9) had just expressed the view that the *Leptocephali* are the larvæ of eels ("Congers"), and that *Leptocephalus morrisii* is the young of the conger eel. This conclusion was also reached independently by Dareste (C. 1873.3). Günther (A. 1859.1, vol. viii, 1870, 1880.4) accepted Gill's view, but thought that they were abnormally developed conger larvæ, which view was likewise accepted by Bellotti (C. Add. 1883.1).

The actual proof of Gill's view was first made by Delage (M. Y. 1886.1) who kept a specimen of *L. morrisii* in the aquarium of the Roscoff laboratory and observed its transformation into a small conger, 9.3 cm. in length.

The way was now paved for the discovery of the larval form of the common eel. Kaup (J. J. 1860.4) had previously described one of the Mediterranean *Lep-*

tocephali as *Leptocephalus brevirostris*. In 1893, the epoch-making discovery that this form is the larval form of the common eel, *Anguilla vulgaris*, was announced by Grassi and Calandruccio (1892.1-1903.1), who had found the necessary transitional stages.

Not until 1904 had any *Leptocephali* of the common eel been observed outside of the Mediterranean. In this year Schmidt (1904.1) took a *Leptocephalus* of the European eel west of the Faroe Islands. A second specimen was taken on the west coast of Ireland in 1904 by Farran (Holt, E. W. 1909.1). Subsequently numerous larvæ were found in the northeastern Atlantic. Jacoby (L. 1867.1-1882.1) believed the breeding ground to be off the coast in deep water. Schmidt (E. J. 1909.5) found the south Atlantic to be devoid of *Leptocephali*. Hjort (J. 1910.1) and Lea (E. 1913.2) suggested that the breeding grounds would be found in the central Atlantic between the Azores and the Bermudas. Schmidt, from investigations in the open Atlantic in the schooner "Margrethe," 1913, and with over 500 gatherings made for him on board various coöperating Danish ships, found that the *Leptocephali* increased in number but decreased in size as he went from Europe toward the West Indies. Small sizes were found concentrated in a comparatively small area, extending from 22° N. to 30° N. and from 40° W. to 65° W.; the central portion lying about latitude 26° N. or approximately equidistant from the Leeward Isles and from Bermuda. This is the breeding place of the eel. At this point the smallest larvæ were found concentrated in considerable numbers. In his most recent paper ("The Breeding Places of the Eel," etc. p. 206), Schmidt has summarized the breeding habits of the eel as follows:

"Spawning commences in early spring, lasting to well on in summer. The tiny larvæ, 7-15 mm. long, float in water-layers about 200-300 metres from the surface, in a temperature of about 20° C. The larvæ grow rapidly during their first months, and in their first summer average about 25 mm. in length. They now move up into the uppermost water-layers, the great majority being found between 50 and 25 metres, or at times even at the surface itself. Then they commence their journey towards the shores of Europe, aided by the eastward movement of the surface-water itself. During their first summer, they are to be found in the western Atlantic (west of 50° long. W.). By their second summer they have attained an average length of 50-55 mm., and the bulk are now in the central Atlantic. By the third summer, they have arrived off the coastal banks of Europe and are now full-grown, averaging about 75 mm. in length, but still retaining the compressed leaf-shaped larval form. In the course of the autumn and winter, they undergo the retrograde metamorphosis which gives them their shape as eels and brings them to the elver stage, in which they move in to the shores and make their way up rivers and watercourses everywhere. . . . The eels utilise their sojourn in fresh water to feed and grow big, but the duration of their

stay here varies greatly, according to sex, climate and quantity of food, ranging from about 5 to about 20 years or more. All the large eels are females; the males seldom exceed 45 cm. in length."

The *Leptocephalus* of the American eel (*Anguilla rostrata*) was first described by Eigenmann & Kennedy (1902.1) as *L. grassii*. It is distinguished from that of the European eel (*A. vulgaris*) by the smaller number of myomeres, and in the adult by the smaller number of vertebrae.

Schmidt found that the breeding grounds of the American species lie along the entire range north of the West Indies, with their central portion lying west and south of the central breeding grounds of the European eel. Therefore the two grounds overlap and the larvae of the two species are intermingled in the mid-Atlantic. Schmidt says (Phil. Trans. Roy. Soc. 1922, p. 204):

"How do the masses of larvae in the western Atlantic sort themselves out, so that those individuals which belong to *Anguilla vulgaris* ultimately find themselves in Europe, while those of *Anguilla rostrata* 'land' on the shores of America and the West Indies?"

"In the main, the question is no longer difficult to answer. In the case of the American eel, the pelagic larval stage is terminated in about one year; consequently the larvae have not time to make the journey to Europe, the distance being more than they can cover in that period. It is otherwise with the European eel, which takes nearly three times as long over its larval development, as a result of which practically all of them are far away from the western (American) portion of the Atlantic when the time comes for them, as elvers, to seek the coasts."

Young eels (elvers), during their ascent of streams, will follow up the smallest trickle of water. The following papers record the obstruction of water pipes in this way. Bean, B. A. 1892.3; Bishop, W. L. 1908.1; Nye, W. 1883.1.

Capture of adult eels in the open sea. Cligny, A. 1912.1,6; Vaillant, L. L. 1898.3,5.

Marking experiments, chiefly in Finland, with adult eels to determine the rate of seaward migrations. Nordqvist, O. F. 1903.3,6, 1904.1,2,3; Schneider, G. 1904.10, 1905.9, 1908.4; Trybom, F. & Schneider, G. 1908.1,2,3.

Sexes of the Eel

Because of the location of their breeding ground, the capture of sexually mature eels has been infrequent. The following historical resumé, with necessary insertion of citations, is quoted from Schmidt (E. J. 1906.1, p. 138).

"The Italian Mondini (C. 1783.1) first described the ovary or female genital organ of the eel in 1777, and the Dane O. F. Müller independently in 1780. The correctness of the determination was confirmed in 1838 by the German Rathke (M. H. 1838.1), who later in 1850 (1850.1) further described a female eel, in the ovary of which he could detect eggs 1/10 millimeter in diameter. Between Mondini's discovery in 1777 of the female genital organs and the discovery of the male organs a period of a hundred years elapsed. The reason for this may

be found partly in the fact, that no one had noticed the peculiarity that the male eels are considerably smaller than the females, and the males were consequently being sought for amongst the large eels without result. In 1874 the Austrian Syrski (S. 1874.2, 1875.1,2, 1876.1) first described the male organ of the eel, and this has very often in consequence been called 'Syrski's organ,' or on account of its fold-like appearance the 'lobed organ.' Syrski's observations were later confirmed and amplified by a number of observers in various countries."

Other papers recording male or female eels; relating to the state of their reproductive organs, or dealing with their sexual dimorphism. ★Balsamo-Crivelli, G. & Maggi, L. 1872.1,2, 1873.1; Barfod, H. 1902.4; Calderwood, W. L. 1893.2; Cattie, J. T. 1880.1; Cunningham, J. T. 1895.9; Freud, S. 1877.1; Feddersen, A. F. 1893.1, 1894.1; Giacomini, E. 1908.1; Gill, T. N. 1881.3; H. 1893.1; Hermes, O. 1880.2, 1881.1; Joly de Saily, — 1907.1; Kingsley, J. S. 1879.1; Lepori, C. 1883.1; ★Mazza, F. 1912.1, 1913.1; Möbius, K. A. 1887.1; Münter, J. A. 1873.1; Packard, A. S. 1879.2; Packard, A. S. & Kingsley, J. S. 1879.1; Pavesi, P. 1880.1, 1887.2; Putnam, F. W. 1878.1; Rauber, A. 1875.1; Ritsema, C. 1875.1; Robin, C. P. 1881.1; Ryder, J. A. 1885.5; Sawyer, J. G. 1879.1; Schmidt, F. 1874.1; Trybom, F. 1902.3; Schluesser, G. Add. 1848.1; Anon. 353.

Hermaphroditism. Ercolani, G. B. 1871.1, 1872.1,2; Nardo, G. D. 1871.2; Anon. 7.

Various Leptocephali

Occurrence of *Leptocephalus brevirostris*, larval form of the European eel, in waters of the North Atlantic and about the British Isles. Bowman, A. 1913.1; Herdman, W. A., Scott, A. & Johnstone, J. 1899.1; Hillas, A. B. 1910.1; Hjort, J. 1910.1; Holt, E. W. 1908.1, 1909.2; Petersen, C. G. 1905.1; Schmidt, E. J. 1909.4; Lea, E. Add. 1913.1.

Occurrence of *Leptocephalus morrisii*, larval form of the conger eel, in British waters. Cunningham, J. T. 1891.8, 1893.5, 1895.4, 1897.2; Edwards, T. 1878.1; Fulton, T. W. 1904.1, 1905.2; Gilson, G. 1908.2; Deere, H. V. Add. 1833.1.

Various papers describing new species of *Leptocephalus*, or other taxonomic notes, *Leptocephali* of various regions, etc. This list is assumed to be incomplete. Blegvad, H. 1913.1; Haast, J. F. 1875.2; Kölliker, R. A. 1853.1; Pappenheim, P. 1914.1; Peters, W. C. 1859.1, 1865.1; Schmidt, E. J. 1910.1; Steindachner, F. 1870.3; Storer, D. H. 1848.2; ★Strömman, H. 1896.1; Bellotti, C. Add. 1883.1; Facciola, L. Add. 1883.1,2, 1885.1; Schmidt, J. 1912.1.

General Literature

The principal literature and the important steps in the development of our knowledge concerning the breeding habits and life history of the eel have been detailed above. The following citations include the great bulk of other references

to the life history, breeding and feeding habits, migrations, etc. which in general, however, do not present original important contributions. Most of these papers refer to the European eel.

Text in Danish or Norwegian. Dahl, K. 1909.5; Feddersen, A. F. 1896.1; ★Grassi, G. B. & Calandruccio, S. 1898.1; Grieg, J. A. 1895.1, 1897.2, 1910.2; Hansen-Larsen, C. 1906.1; Leth, F. H. 1882.1, 1892.1, 1897.1; ★Petersen, C. G. 1895.1, 1904.1, 1907.1; ★Schmidt, E. J. 1912.3; Willumsen, P. J. 1892.1, 1895.1, 1897.1; Anon. 8; Jensen, A. S. Add. 1892.1.

Text in English. General papers. Cunningham, J. T. 1902.1, 1910.1; Day, F. 1889.2, 1890.4; Dean, B. 1912.1; Eigenmann, C. H. 1901.1, 1902.7; ★Fulton, T. W. 1890.2; Goode, G. B. 1881.1, 1882.4; ★Grassi, G. B. 1896.1; Hermes, O. 1882.1, 1886.1; ★Holt, E. W. 1909.1; Jacoby, L. 1882.1; ★Johansen, A. C. 1905.2; Kofoed, C. A. 1908.1; McIntosh, W. C. 1885.2; Maill, L. C. 1897.1; Murray, J. & Hjort, J. 1912.1; Southwell, T. 1885.1, 1892.1, 1894.1; ★Strubberg, A. 1913.1; Williamson, H. C. 1895.2.

Miscellaneous notes in English. Adams, A. 1861.3; Atkinson, J. C. 1844.1; Baird, S. F. 1872.16, 1873.34, 1878.6; Bean, T. H. 1889.13; Blackford, E. G. 1899.1; Canavan, E. 1893.1; Carlisle, A. 1822.1; Carr, J. 1809.2; Cheney, A. N. 1899.1; Clarke, S. C. 1876.3; Cobb, J. N. 1909.1; Cornish, T. 1866.2; Fraser, J. E. 1891.1; Gill, T. N. 1899.1, 1908.4; Hall, T. S. 1905.1; Hopkins, W. 1903.1; Keene, J. H. 1881.3; Kershaw, J. A. 1911.1; Liddell, H. T. 1838.1; Marsh, M. C. 1902.2; Osburn, R. C. 1911.2; Packard, A. S. 1879.1, 2, 3; Pike, N. 1880.1; Roosevelt, R. B. 1877.1, 1879.1, 1880.2; Tilloch, A. 1809.1; Yarrell, W. 1833.1; Young, A. 1843.2; Brown, A. W. Add. 1896.1; Gage, S. H. Add. 1878.1; Gibbs, T. Add. 1897.1; Smith, H. M. Add. 1913.2. — *Pre-Linnaean references.* Allen, B. 1698.1; Dale, S. 1699.1; Leeuwenhoek, A. 1696.1; Wren, C. 1756.1.

Text in French. Acloque, A. 1894.1, 1897.1, 2; Blanchard, C. E. 1890.1; Blot, M. 1911.1; Brandicourt, V. 1891.1, 1897.1; Chevrel, R. 1898.1; Cligny, A. 1897.1; Daleau, F. 1909.1; Dareste, C. 1875.2; Deslongchamps, J. A. 1835.1, 1838.2; Dubois, M. 1875.1; Fauvel, A. 1873.1; Gandolfi-Horygold, A. 1911.1; Gilson, G. 1908.1, Add. 1908.1; Godet, P. 1899.1; Huard, V. A. 1901.1; Joannis, L. 1839.2; Jourdain, S. 1889.1; La Blanchère, P. R. 1876.2; Laloy, L. 1910.1; Lamouroux, J. V. F. 1811.1; Maison, E. 1896.1; Moullin du Coudray, P. R. 1876.1; Nansouty, M. 1907.1; Olivier, E. 1910.1; Rivière, — 1840.1, 1841.1; Roule, L. 1909.3, 1911.4; Schaeck, M. 1894.1; Selys-Longchamps, M. E. 1873.1; Trevelyan, W. C. 1841.1; Vailant, L. L. 1889.2, 1890.2; Varigny, H. C. 1897.2; Bougon, — Add. 1899.1.

Text in German. General papers. Balsamo-Crivelli, G. & Maggi, L. 1872.2; Ehrenbaum, E. 1907.1, 2, 1911.2, Add. 1913.1, 14, Add. 1914.1; Franz, V. 1908.3, 1910.10, Add. 1913.1; ★Grassi, G. B. & Calandruccio, S. 1897.2, 1898.2; Kaup, J. J. 1856.6; La Motte, F. 1893.1; Leonhardt, E. E. 1902.2; Linstow, O. 1900.1; Nilsson, S. 1861.1; Pintner, T. 1908.1; ★Schmidt, E. J. 1911.2, 1912.6; Simroth, H. R. 1915.1; ★Walter, E. 1910.2. — *Old conceptions of reproduction of eel.* Paulus, — 1896.1; Schubert, O. 1902.1; Troschel, F. H. 1875.1; Döbel, H. Pre-Linn. 1746.1; Fahlberg, A. Pre-Linn. 1754.1.

Miscellaneous notes. Text in German. Becker, G. 1903.1; Bellini, A. 1901.1; Braess, M. 1908.1; Bodin, T. 1878.1; Brandes, G. 1898.1; Brandt, K. 1898.2, 1905.1; Buxbaum, L. 1892.2; Dallmer, E. 1878.5; Fechner, C. A. 1864.1; Finn, W. 1878.3; Frenzel, J. 1897.2; Greve, — 1874.1; Grube, A. E. 1875.2; Hermes, O. 1880.1, 4, 1882.2; Imhof, O. E. 1896.1; Jacoby, L. 1880.2; Järvi, T. H. 1909.2; Kaumann, — 1878.1; Knauthe, K. 1896.3; Koenig, A. F. 1898.1; Krause, E. 1897.1; Krebs, W. 1911.2, 1912.1; Landois, H. 1868.1; Linden, M. 1905.1; Lindenhain, G. 1880.1; Lorenz, P. 1896.1; Lübbert, H. O. 1908.2; Luehe, — 1897.1; Lühe, M. 1908.1; Lüning, — 1865.1; Melzheimer, M. 1876.1, 1877.1; Müller, A. 1874.1; Müller, C. 1911.1; Nehrkorn, A. 1880.1; Nicklas, C. 1879.1; Pauly, A. 1880.1; Pietschmann, V. 1908.1; Reichard, A. O. 1911.1; Schlesinger, F. W. 1900.2; Schmidt, Franz. 1878.1; Schultz, C. 1911.1; Schweder, G. 1908.1; Seelig, F. W. 1897.1; Seidlitz, G. 1878.1; Seligo, A. 1904.1, 1906.1; Siebold, C. T. 1882.1; Spengel, J. W. 1899.1; Steemann, — 1878.1; Steuber, N. J. 1905.1; Strombeck, — 1876.1; Trost, J. 1865.1; Ubisch, L. 1911.1; Völtzkow, A. 1890.1; Zenk, F. 1891.1; Zur Mühlen, M. 1911.20; Anon. 1, 2, 6, 12, 89, 91, 245, 246, 334, 400, 401, 558, 562, 567, 611, 643, 644, 645, 647, 648, 782; Blochmann, F. Add. 1898.1; Christopher, H. Add. 1914.1.

Text in Italian. Amoretti, C. 1803.1; Bellini, A. 1908.1; Canestrini, G. 1872.2; ★Facciola, L. 1893.1–1897.4, 1901.2–1903.1; Garbiglietti, A. 1872.1; ★Grassi, G. B. 1887.1, 1910.1; ★Grassi, G. B. & Calandruccio, S. 1894.1, 1897.3, 1903.1; Mazza, F. 1912.1, 1913.1; Nardo, G. D. 1871.2; Predieri, P. 1872.1; Ricci, O. 1902.1; Sanzo, L. 1905.1; Spallanzani, L. 1826.1, 1832.1; Supino, F. 1908.2; Tigri, A. 1872.1, 2; Torossi, G. B. 1898.1; Voltolina, V. 1902.1; Vincenzio di Eugenio, V. Add. 1902.1; Marsigli, L. F. Pre-Linn. 1717.1; Redi, F. Pre-Linn. 1684.1.

Text in various languages. — Dutch. Hall, H. C. 1873.1; Harting, P. 1865.4, 1872.6, 1875.4, 5; Hoek, P. P. 1908.1; Popta, C. M. 1903.1; Posthumus, L. 1875.1; Breemen, J. P. Add. 1906.1. — *Finnish.* Grotrian, — 1898.1; ★Järvi, T. H. 1909.1;

Levander, K. M. 1897.1. — *Icelandic*. Sæmundsson, B. 1911.1; Olavsen, O. Add. 1783.1. — *Latin*. Hohnbaum-Hornschuch, R. 1842.1; Monti, G. 1783.1, 2; Schneider, J. G. 1782.1. — *Early references in Pre-Linnæan section (Latin)*. Camerarius, J. R. 1624.1, 1683.1; Elsner, J. G. 1670.1; Jacobaeus, O. 1680.3; Langius, C. 1688.1; Leeuwenhoek, A. 1697.1; Matthæus. 1673.1; Paulini, C. F. 1689.1; Vallisnieri, A. 1712.1. — *Polish*. Snizek, J. 1909.1; Anon. 625. — *Swedish*. Drewsen, C. 1837.1; Grottrian, — 1898.1; Levander, K. M. 1906.4; Lönnberg, A. J. 1895.5, 7; Palmén, J. A. 1904.1–1911.1; ★Schmidt, J. Add. 1912.1; Geer, C. Pre-Linn. 1750.1.

Taxonomy

Classification of species of Anguilla and their distribution throughout the world. ★Schmidt, E. J. 1909.2, 3, 6, 1914.2. — *Proper scientific name of the American eel, Anguilla rostrata*. Bean, B. A. 1909.1; Clark, Austin H. 1903.1. — *Absence in Danube, causes*. Lohr, A. 1902.1. — *Indo-Pacific species of Anguillidae*. Weber, M. C. 1912.1.

OTHER GENERA OF THE ANGUILLIDÆ

Conger (*Sea Eel*). For a map showing the geographical distribution of the genus *Conger*, see Meek, A. 1916.1 (p. 160).

Numerous references to the *Leptocephali* of the *Conger*, formerly confused with larval stages of the common eel, will be found above under *Anguilla*.

Moringua and allies. *Distribution*. Gill, T. N. & Smith, H. M. 1900.1, 2.

Murænesox. *Taxonomy based on osteological characters*. Gill, T. N. 1891.10.

Ophichthys (*Snake Eel*). — *Natural history notes*. Abt, F. N. 1789.1; Ahl, J. N. 1789.1, 1801.1; Bellotti, C. 1890.1; Persoon, C. H. 1801.1. — *Nomenclature*. Jordan, D. S. & Gilbert, C. H. 1883.22.

Family Nemichthyidae

Structure and classification. Gill, T. N. & Ryder, J. A. 1877.1; Roule, L. 1910.4.

Nemichthys (*Snipe Eel*). *Structure and taxonomy*. Adams, A. 1861.3; Brandt, J. F. & Lowe, R. T. 1854.1; Jordan, D. S. & Gilbert, C. H. 1880.15; Roule, L. 1910.1.

Family Synphobranchidae

Taxonomy, based on osteological characters. Gill, T. N. 1891.13.

Family Saccopharyngidae

Taxonomy and nomenclature. Gill, T. N. & Ryder, J. A. 1885.1; Regan, C. T. (*Lyomeri*) 1912.3; Gill, T. N. Add. 1884.7.

Eurypharynx and **Gastrostomus**. *Structure and taxonomy*. Gill, T. N. & Ryder, J. A. 1884.2, 3; Gill, T. N. Add. 1884.7; Vaillant, L. L. 1882.1.

Saccopharynx. *Taxonomy and descriptions*. Girard, A. A. 1895.1; Mitchill, S. L. 1824.2, 1825.3.

Family Murænidæ

Muræna. *Natural history notes*. Carington, J. T. 1876.2; Grassi, G. B. 1910.1; Holt, E. W. Add. 1897.5.

SUB-ORDER HAPLOMI

Taxonomy. — *General account*. Jordan, D. S. 1885.11. — *Synopsis of characters*. Starks, E. C. 1904.3. — *Revision, African species*. Boulenger, G. A. Add. 1909.1.

Family Galaxiidae

For maps showing the distribution of the *Galaxiidae*, see Boulenger, G. A. 1904.7 (p. 607), and Meek, A. 1916.1 (p. 146).

Taxonomy. — *New Zealand forms*. Clarke, F. E. 1899.1. — *Revision*. Regan, C. T. 1905.14.

Galaxias. *Taxonomy and distribution*. Ogilby, J. D. 1896.4; Macleay, W. J. Add. 1881.1. — *Geographical distribution*. Boulenger, G. A. 1902.15.

For burrowing habits, see under *Aestivation*.

Neochanna. *Natural history and occurrence*. Günther, A. C. 1867.7. — *In New Zealand*. Günther, A. C. & Hector, J. 1867.1; Fitzgerald, G. G. 1873.1; Vollams, S. E. 1873.1.

Family Haplochitonidae

For a map showing the geographical distribution of the *Haplochitonidae*, see Meek, A. 1916.1 (p. 146).

Prototroctes. *Natural history and distribution in Australia*. Stead, D. G. 1903.1.

Family Enchodontidae

Structure and classification of these Cretaceous fishes. Woodward, A. S. 1889.2.

Family Esocidae

For maps showing the distribution of the *Esocidae*, see Boulenger, G. A. 1904.7 (p. 610), and Meek, A. 1916.1 (p. 180).

Taxonomy; North American species. Cope, E. D. 1869.3. — *Canada*. Prince, E. E. 1896.2.

Esox (*Chiefly E. lucius and E. reticulatus*) (*Pike*). *General treatises*. Cholmondeley-Pennell, H. 1865.1; ★Henshall, J. A. 1903.1; ★Serrane, F. 1908.1; Anon. 446; Kendall, W. C. Add. 1887.1.

Natural history, popular accounts, etc. Text in English. Ayres, W. O. 1849.6; Badham, C. D. 1853.2; Bean, T. H. 1911.18; Brougham, W. H. 1879.2; Cheney, A. N. 1896.4, Add. 1893.1, 1898.2; G., — 1876.2; Hewitson, J. 1877.1; Keene, J. H. 1879.5; Robertson, D. 1890.2; Anon. 447. — *Tenacity of life*. Prime, W. C. 1876.1. — *In salt water*. Todd, F. 1877.1.

Natural history. French. Acloque, A. 1900.2; Carbonnier, P. 1867.1; Dubreuil, E. 1870.1; Sauvadon, G. 1868.1; Snickt, L. 1896.1.

Natural history. German. Büren, A. 1897.1; Dallmer, E. 1877.2; G., L. 1875.2; Leonhardt, E. E. 1905.13; Lindes, L. 1880.10; Müller, — 1877.1; Schöpf, J. D. 1784.1; Spohrer, — 1897.1; Ule, W. 1897.1.

Natural history. Various languages. — *Danish.* Sauvadon, G. 1870.1. — *Dutch.* Pollen, F. P. L. 1871.4. — *Finnish.* Lydén, K. 1893.1; Sandman, J. A. 1894.6. — *Hungarian.* Grubiczy, G. 1876.1. — *Italian.* Supino, F. 1909.2. — *Latin.* Camerarius, J. R. Pre-Linn. 1624.1.

Growth, age and size. Clark-Kennedy, A. 1867.2, 1868.1, 1879.1; Surbeck, G. 1904.6; Anon. 28, 464; Sturtevant, E. L. Add. 1871.1.

Taxonomy and nomenclature. — *American species.* Evermann, B. W. 1898.3; Gill, T. N. 1896.3; Meek, S. E. & Newland, R. G. 1886.2; Milner, J. W. 1876.2. — *Varieties.* Knauthe, K. 1902.2.

Esox masquinongy (Muskallunge). *Natural history notes, miscellaneous accounts, etc.* Ayres, W. O. 1852.2; Cheney, A. N. 1896.4; Desrochers, J. E. 1895.1; Evermann, B. W. 1902.21, 1906.2; Stockwell, G. A. 1875.1, 1883.1; Bean, T. H. Add. 1908.1.

Nomenclature; vernacular names. Armstrong, J. O. Add. 1904.1; Chambers, E. T. Add. 1904.1, 2; Henshall, J. A. Add. 1904.1.

For the various spellings of the name of this fish, see Ida M. Mellen "Twenty four ways of spelling the name of a fish [Muskallunge]." *Bull. N. Y. Zool. Soc.*, 1917, vol. 20, p. 1558.

Esox. *Fossil forms in* — *India.* Falconer, H. 1868.1. — *Thuringia.* Richter, R. 1879.1. — *Miocene of Baden.* Winkler, T. C. 1861.1.

Umbra (Mud Minnow). *Natural history.* ★Gill, T. N. 1904.7; Herman, O. Add. 1882.1; Károli, J. Add. 1882.1. — *Mistaken for Fundulus.* Carbonnier, P. 1874.1. — *Differentiated from Fundulus.* Gill, T. N. 1906.2.

Family Dalliidæ

Dallia. *Natural history.* Turner, L. M. 1886.1.

Family Scopelidæ

For the structure and functions of the phosphorescent organs of these fishes, see under Luminosity and Phosphorescence.

Structure and taxonomy. ★Lütken, C. F. (Arctic Seas) 1876.1 (viii), (Synopsis) 1892.1; ★Gilbert, C. H. 1906.1, 1908.1, 1911.1, (Japan) 1913.2. — *Of fossil forms.* Woodward, A. S. 1889.2.

Myctophum. *Taxonomy; synopsis.* ★Brauer, A. 1904.2.

Paralepis. *Occurrence in* — *Mediterranean.* Bellotti, C. 1878.1. — *Cornwall.* Day, F. 1883.7. — *New Jersey.* Fowler, H. W. & Phillips, R. J. 1910.1. — *Washington.* Jordan, D. S. & Gilbert, C. H. 1880.17.

Prymnothonus. *Taxonomy; review.* Dollo, L. 1907.1.

Scopelus. *Taxonomy and distribution.* — *On British coast.* Clarke, W. Branwhite, 1838.1; Edwards, T. 1863.1. — *Sicily and the Mediterranean.* Facciola, L. 1882.2; Raffaele, F. 1889.1; Risso, A. 1820.1. — *Synopsis of species, Irish Atlantic slope.* Holt, E. W. L. & Byrne, L. W. 1911.1. — *China.* Steindachner, F. 1867.5 (iv).

Family Synodontidæ

Taxonomy; review of the Lizard fishes of Japan. Jordan, D. S. & Herre, A. C. 1907.2.

Synodus. *Taxonomy; review, American species.* Meek, S. E. 1885.2.

Family Alepidosauridæ

Alepidosaurus (Plagyodus). *Natural history.* Evermann, B. W. 1899.3. — *History and taxonomy.* Günther, A. C. 1860.1, 1867.8, 1901.1.

Occurrence — *on California coast.* Hartley, F. 1895.1. — *at New Zealand.* Hutton, F. W. 1902.2. — *at Madeira.* Johnson, J. Y. 1862.2. — *off Gloucester, Mass.* Oakes, O. H. 1877.1.

Families Cetominidæ and Rondeletiidæ

Taxonomy. Goode, G. B. & Bean, T. H. 1894.1.

Family Chirothricidæ

Taxonomy, Cretaceous of Germany and Syria. Woodward, A. S. 1889.2.

Family Kneridæ

Taxonomy. Gill, T. N. 1903.1.

Group Microcyprini

Comprising Amblyopsidæ and Cyprinodontidæ
Classification. Regan, C. T. 1911.15.

Family Cyprinodontidæ (Pœciliidæ)

For ovarian reproduction in Pœciliidæ, see Viviparity, under Reproduction.

For maps showing the distribution of the Cyprinodontidæ, see Boulenger, G. A. 1904.7 (p. 617), and Meek, A. 1916.1 (p. 184).

General treatise. ★Garman, S. 1895.1.

Natural history. Brüning, C. 1910.2; Emeljanenko, P. E. 1908.2; Peter, J. 1901.1.

Nomenclature. Gill, T. N. 1895.4, 1896.10.

Taxonomy. — *Europeana forms.* Bellotti, C. & Panceri, P. 1856.1. — *Indian species.* Day, F. 1868.1. — *South American species.* Eigenmann, C. H. 1907.4; ★Henn, A. W. 1916.1. — *Asia Minor and Syria.* Gaillard, C. 1895.1. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1906.3. — *General paper.* Müller, J. 1844.1. — *Mexico.* Steindachner, F. 1863.2. — *Revision, African species.* Boulenger, G. A. Add. 1909.1.

Anableps (Four-eyed Fish). *Natural history.* Clarke, W. H. & Mortimer, J.

1839.1; Steward, — 1895.1; Dow, J. M. 1861.1, Add. 1861.1.

For the peculiar structure of the eye of Anableps, see under Eye.

Cynolebias, Pterolebias, and Rivulus. *Taxonomy; revision.* Regan, C. T. 1912.19.

Fundulus. *Natural history.* Nichols, J. T. 1912.6. — *Color variety.* Fischer, H. 1910.1.

Jenynsia. *Taxonomy; revision.* Regan, C. T. 1913.16.

Lebias. *Natural history, L. calaritana.* Mazza, F. 1897.1.

Fossil forms, structure and taxonomy. — *Tertiary.* Agassiz, J. L. 1832.2. — *Tertiary of Germany.* Meyer, C. E. 1831.1; Münster, G. 1836.1. — *Miocene of Germany.* Winkler, T. C. 1861.1. — *Oligocene of Germany.* Winkler, T. C. 1880.3.

Orestias. *Occurrence in Andean plateau, natural history and taxonomy.* Boulenger, G. A. 1902.4; Evermann, B. W. & Radcliffe, L. 1909.1; Pellegrin, J. 1904.7, 1907.10. — *See also C. H. Eigenmann in Copeia, 1920, no. 89, pp. 103–105.*

Phallostethus. *Structure and classification.* Regan, C. T. 1913.14.

Sub-family Pœciliinæ

Nomenclature. Rachow, A. 1914.10.

Taxonomy; revision. Regan, C. T. 1913.18.

Gambusia. *Natural history.* Dugès, A. 1902.1; Kuntz, A. Add. 1914.2.

Girardinus. *Taxonomy; review.* Ihering, H. 1883.1.

Molliensia. *As male of Pœcilia multilineata.* Agassiz, J. L. R. 1858.5.

Pœcilia. *Natural history.* Brüning, C. 1903.3; Heckel, J. J. 1848.1.

Fossil forms in Miocene of Baden. Winkler, T. C. 1861.1; Woodward, A. S. 1898.6.

Family Amblyopsidæ

The Cave-fishes

For a map showing the distribution of the Amblyopsidæ, see Meek, A. 1916.1 (p. 184).

For other fishes with degenerate eyes, see Blind fishes of the Caves.

Various notes on Amblyopsidæ. Eigenmann, C. H. 1899.1, 4, 5, 8, 1900.1, 2; Forbes, S. A. 1882.1; Girard, C. F. 1888.1, 2; Putnam, F. W. 1872.1, 2, 1875.1, 2.

Revisions of the Amblyopsidæ, with literature. ★Cox, U. O. 1905.1; ★Eigenmann, C. H. 1909.2; Putnam, F. W. 1872.10.

Amblyopsis. *Ear and hearing.* Eigenmann, C. H. & Yoder, A. C. 1899.1; Payne, F. 1909.1; Wyman, J. 1854.5.

Eye, anatomy and development. ★Eigenmann, C. H. 1899.7, 1900.4, 1901.2, 1909.2, Add. 1898.1, 1900.1; Eigenmann, C. H. & Denny, W. A. 1899.1; Tellkamp, T. A. 1870.1; Wyman, J. 1851.1, 1854.5. — *Reactions to light.* Payne, F. 1907.1. — *Brain, optic lobes and tracts.* Ramsey, E. E. 1901.1, 1909.1.

Smaller papers on Amblyopsis; records, remarks, notes, popular accounts, etc. Agassiz, J. L. 1847.3, 1851.1; Baird, S. F. 1871.27; Banta, A. M. 1907.1; Blatchley, W. S. 1896.1; Cope, E. D. 1871.5; Garman, H. — 1892.1; Hahn, W. L. 1908.1; Mocquard, F. 1908.1; Schreitmüller, W. 1915.2; Taylor, J. E. 1873.1; Thompson, W. 1844.1; Wilson, J. 1854.1; Wyman, J. 1843.1; Anon. 248.

Chologaster (*An eyed member of the Amblyopsidæ*). Agassiz, J. L. 1853.6; Eigenmann, C. H. 1899.3; Putnam, F. W. 1880.1.

Troglichthys rosæ (Eigenmann) (*A markedly degenerate Amblyopsid from caves of Missouri*). Eigenmann, C. H. 1897.3, 1899.2; Garman, S. 1889.1.

Typlichthys subterraneus (Girard) (*An Amblyopsid from Kentucky caves*). Eigenmann, C. H. 1899.2; Girard, C. F. 1859.2; 1888.1, 2; Putnam, F. W. 1872.1, 2, 1875.1, 2.

Family Stephanoberycidæ

Original description. Gill, T. N. Add. 1884.2.

Family Percopsidæ (Salmopercæ)

For a map showing the distribution of the Percopsidæ, see Meek, A. 1916.1 (p. 184).

Taxonomy. Eigenmann, C. H. (*Pacific slope, U. S. A.*) 1892.9; Regan, C. T. 1911.3.

SUB-ORDER HETEROMI

Taxonomy; revision. Goode, G. B. & Bean, T. H. 1894.3.

Family Dercetidæ

Structure and taxonomy, Cretaceous. Woodward, A. S. 1889.2.

Family Halosauridæ

Taxonomy. Gill, T. N. 1889.2.

Family Notacanthidæ

Taxonomy. Bleeker, P. (*Sunda-Molucca Archipelago*) 1850.4; Gill, T. N. 1889.4.

Family Fierasferidæ

Fierasfer (*Echidion, Lefroyia, Oxybeles, syns.*). *General treatise.* ★Emery, C. 1880.1, 2.

Natural history, including references to symbiotic habits and larval forms (Encheliophis and Vexillifer). Costa, A. 1871.2; Emery, C. 1879.1 (iii), 1879.2 (i); Kaup, J. J. 1856.4, 1860.4; Putnam, F. W. 1874.4. — *For association with echinoderms, pearl oysters, and tunicates, see also under Commensalism and Symbiosis.*

Occurrence. — *In East Indies.* Bleeker, P. 1851.18, 1854.17, 1858.14. — *In Norwegian waters.* Collett, R. 1882.1. — *In Scotland.* Edwards, T. (*Banff*) 1863.2; Sim, G. (*Aberdeen*) 1883.3. — *In Ireland.* Thompson, W. 1837.1.

SUB-ORDER CATOSTEOMI

"Limits and contents" of the group. Boulenger, G. A. 1901.15.

DIVISION SELENICHTHYES

Family Lamprididae

Taxonomy. Gill, T. N. 1903.8; Regan, C. T. 1907.11. — *Australian forms.* Kershaw, J. A. 1913.1.

Lampris. *Natural history.* Fulton, T. W. 1901.1, 1902.1, 1903.2; Holten, H. S. 1902.1; Katuric, M. 1902.1; Morton, A. 1897.1; Shufeldt, R. W. 1893.2.

Occurrence. — *on British coast.* Clarke, J. B. (Shetland) 1905.1; Cornish, T. (Cornwall) 1865.1; Gray, J. E. 1861.2. — *in California.* Evermann, B. W. 1896.2. — *on Dutch coast.* Lidth de Jeude, T. W. 1889.1. — *on Murman Coast.* Lönnberg, A. J. 1900.4. — *in New Zealand waters.* Waite, E. R. 1899.2. — *on the Grand Banks.* Jordan, D. S. Add. 1889.2.

Taxonomy and relationships. Boulenger, G. A. 1901.15; Brünnich, M. T. 1788.2; Retzius, A. J. 1799.1; Gill, T. N. Add. 1903.4. — *Earliest description.* Mortimer, C. Pre-Linn. 1750.1.

DIVISION HEMIBRANCHII

Taxonomy; — Synopsis. Gill, T. N. 1885.3. — *Review, Japan.* Jordan, D. S. & Starks, E. C. 1903.4. — *Fossil forms.* Woodward, A. S. 1889.2.

Family Gasterosteidae

The Sticklebacks

For a map showing the geographical distribution of the Gasterosteidae, see Boulenger, G. A. 1904.7 (p. 631).

Taxonomy. — *Review; American species.* Eigenmann, C. H. 1887.2. — *Nova Scotia.* Girard, C. F. 1857.5.

Fossil forms. — *In Pleistocene of Nevada.* Hay, O. P. 1907.1. — *Taxonomy.* Jordan, D. S. 1907.3, 1908.2.

Gasterosteus. *Natural history notes, popular articles, etc.* Borcéa, J. 1904.4; Forbes, H. O. 1897.2; Leonhardt, E. E. 1907.2; Lönnberg, A. J. 1898.2; Lühe, M. 1911.1; Martens, E. 1871.1; O., — 1830.1; Ramage, J. 1825.1, 1826.1; Salm-Horstmar, W. F. 1860.1; Schulze, L. 1915.3; Seligo, A. 1901.1; Sprenger, W. 1901.4; ★Swinerton, H. H. 1907.1; Anon. 320, 430, 459, 509; Holt, E. W. Add. 1893.2; Kendall, W. C. Add. 1902.1; Arderon, W. Pre-Linn. 1748.2; Westbeck, Z. Pre-Linn. 1754.1.

Taxonomy. — *Revisions.* Regan, C. T. 1909.15; Sauvage, H. E. 1874.5. — *Species of Ireland.* Thompson, W. 1841.4.

Variability and variations. Bonizzi, P. 1869.2; Boulenger, G. A. (in lateral shields) 1893.3; Day, F. 1878.3; Harting, P. 1878.4; Lunel, G. (of diagnostic characters) 1882.1; Mourgue, M. 1901.3.

For a map showing the distribution of members of the genus Gasterosteus, see Meek, A. 1916.1 (p. 188).

Pygosteus. *Review East Asian forms.* Berg, L. S. 1907.12.

For a map showing the geographical distribution of species of the genus Pygosteus, see Meek, A. 1916.1 (p. 190).

Spinachia. *Natural history.* Petersen, C. G. 1893.5.

For a map showing the distribution of Spinachia, see Meek, A. 1916.1 (p. 194).

Family Aulorhynchidae

For a map showing the geographical distribution of the Aulorhynchidae, see Meek, A. 1916.1 (p. 194).

Taxonomy. Gill, T. N. 1863.12.

Family Centriscidae

Macrorhamposidae, syn.

Taxonomy; synopsis. Regan, C. T. 1914.10.

Centriscus (**Macrorhamposus**) (Snipe-fish). *Natural history and occurrence.* Emery, C. 1879.2 (5); Künstler, J. & Chaîne, J. 1906.1; Rodier, E. 1898.1. — *On French coast.* Brasil, L. & Gadeau de Kerville, H. 1905.1. — *On Chilean coast.* Delfin, F. T. 1899.4. — *In Irish waters.* Patterson, R. 1906.1. — *In Florida waters.* Smith, H. M. 1904.7.

Taxonomy. — *Revision.* Weber, M. C. 1909.3.

Family Amphisilidae

Amphisile. *Taxonomy and occurrence.* Hilgendorf, F. M. 1884.1; Lütken, C. F. (synopsis) 1865.1. — *Palau Is.* Macleay, W. 1879.3.

Group Lophobranchii

(Hippocampids and Syngnathids)

Natural history. Duncker, G. 1900.1; Harting, P. 1872.5; Noll, F. C. 1879.1; Zograf, N. Y. 1901.4.

Taxonomy. Cope, E. D. 1871.9; Gill, T. N. 1896.2; Hollard, H. L. 1850.1; ★Kaup, J. J. 1853.1, 1856.2; Nardo, G. D. 1842.1. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1901.11.

Family Syngnathidae

Pipe-fishes and Sea-horses

Taxonomy — of Genera. ★Duncker, G. 1912.1. — *Australian forms.* Duncker, G. 1909.1. — *Indian forms.* Duncker, G. 1910.1. — *Synopsis; western North America.* Gill, T. N. 1863.24. — *Baltic Sea.* Heincke, F. 1880.1. — *Review of American species.* Swain, J. 1882.3.

Hippocampus (Sea-horse). *Natural history notes; miscellaneous accounts, descriptions, etc.* Baird, S. F. 1872.17; Bert, P. 1867.3; Brittain, T. 1873.1; Dax, L. 1863.1; ★Gill, T. N. 1905.5; Goode, G. B. (on St. Georges Banks) 1878.8; Hutchinson, T. N. 1873.1; Shufeldt, R. W. 1895.1; Anon. 499. — *Tail as a prehensile organ in Hippocampus.* Dufossé, A. 1874.2.

Early descriptions, figures, etc. of the sea-horse. Osburn, R. C. 1915.1; Anon. 730; Eastman, C. R. Add. 1916.2, Add. 1917.4; Moffett, T. Pre-Linn. 1634.1.

Nerophis. *Natural history, occurrence, etc.* Lord, J. K. 1867.4; Smith, John A. 1863.2-4. — *In Ireland.* Barrett-Hamilton, G. E. 1892.1. — *Pelagic form.* Ever-

mann, B. W. & Kendall, W. C. 1908.1. — *In Finland*. Nordqvist, O. F. 1899.8. — *Off British coast*. Holt, E. W. L. & Byrne, L. W. 1904.1. — *Off Scotland*. Young, W. S. 1863.1.

SUB-ORDER PERCESOCES

Structure and taxonomy, fossil forms. Woodward, A. S. 1889.2.

Family Scombresocidae

Taxonomy. Gill, T. N. 1896.3; Regan, C. T. 1911.7. — *Dutch E. Indies*. Bleeker, P. 1862.1. — *Review, American species*. Jordan, D. S. & Fordice, M. W. 1887.1. — *Review, Japan*. Jordan, D. S. & Starks, E. C. 1903.5. — *Revision, African species*. Boulenger, G. A. Add. 1909.1.

Phylogeny and ecology. Schlesinger, G. 1909.2.

Belone (*Gar-fish*). *Natural history, popular accounts, descriptions, etc.* Bianchi, V. 1907.1; Hutchinson, H. G. 1904.1; Anon. 298, 445; Gill, T. N. Add. 1895.1; Martini, F. H. Add. 1775.1; Schoepf, J. D. Add. 1776.1; Jacobaeus, O. Pre-Linn. 1675.1.

Exocætus (*Flying-fish*). *Natural history notes, descriptions, etc.* Brown, T. 1778.1; Lord, W. B. 1866.1. — *In England*. Murie, J. 1905.1, 1906.1; Patterson, A. H. 1906.2; Stephenson, T. 1894.1.

Taxonomy; revisions. Bleeker, P. (*Indian Archip.*) 1866.12; Jordan, D. S. & Meek, S. E. (*America*) 1886.2; ★Lütken, C. F. 1874.1 (vi), 1877.1, 3; Weinland, D. F. 1856.1.

For structure of pectoral fins of Exocætus in adaptation for flight, see under Fins, paired.

For flight of Exocætus, see under Flying fishes and their flight.

Hemirhamphus (*Half-beak*). *Natural history and occurrence*. Andrews, W. 1849.3; Günther, A. C. 1866.3; Malm, A. W. 1852.1; Yarrow, H. C. 1872.1. — *on English coast*. Clarke, W. Barnard 1837.1; Couch, J. 1851.4.

Taxonomy. — *Revision of species of Indian Archip.* Bleeker, P. 1866.10. — *Synopsis of genera*. Gill, T. N. 1864.13. — *Review, American species*. Meek, S. E. & Goss, D. K. 1885.1.

Family Ammodytidae

Taxonomy. Gill, T. N. 1904.6; Regan, C. T. 1913.2. — *Japanese forms; review*. Jordan, D. S. 1906.1.

Ammodytes (*Sand-eel or Launce*). *Natural history notes, miscellaneous accounts, descriptions, etc.* Bowman, A. 1914.1; Cisternas, R. 1875.1; ★Fullerton, J. H. 1894.1; Jourdain, S. 1879.1; ★Masterman, A. T. 1895.1; Pybus, W. M. 1912.1; Sandman, J. A. 1894.3; Schultén, A. B. 1874.1; Anon. 538; Martini, F. H. Add. 1775.1.

Taxonomy, Finland. Gottberg, G. 1910.1.

Family Atherinidae

Taxonomy. Fowler, H. W. 1903.3; Machado de Carvalho, G. 1898.1. — *Review, Japan*. Jordan, D. S. & Starks, E. C. 1901.3. — *Australia*. McCulloch, A. R. 1912.2. — *Madagascar*. Pellegrin, J. 1914.5. — *Western Europe*. Roule, L. 1903.4.

Atherina. *General account, European species*. ★Borsieri, C. 1902.2, 1904.2.

Natural history. Costa, O. G. 1844.2; Krause, E. 1902.1. — *Ovum*. Pagenstecher, H. A. 1861.1. — *Reared in fresh water*. Robertson-Proschowski, A. 1907.1; Roule, L. 1903.3.

Chirostoma. *Occurrence in* — *Lake Chapala, Mexico*. Boulenger, G. A. 1900.7; Jordan, D. S. 1900.4. — *Chile*. Steindachner, F. 1896.3.

Melanotænia and related species. *Taxonomy, Australia*. Ogilby, J. D. 1896.3; Gill, T. N. Add. 1894.1.

Menidia (*Silverside*). *Notes on species in United States*. Kendall, W. C. 1902.1.

Family Mugilidae

Taxonomy. Cuvier, G. L. 1830.1; Fowler, H. W. 1903.6. — *British Guiana*. Hancock, J. 1830.1. — *Revision, American marine forms*. Jordan, D. S. & Swain, J. 1885.5. — *Australia*. Macleay, W. 1880.4.

Mugil (*Mullet*). *Natural history notes*. Carazzi, D. 1913.1; Dannevig, H. C. 1902.4; Hancock, J. 1830.1; Lloyd, W. A. 1867.1; Ninni, E. 1909.1.

Family Polynemidae

Taxonomy. — *Synopsis*. Gill, T. N. 1862.26. — *Review, American species*. Kirsch, P. H. 1890.1.

Family Chiasmodontidae

Taxonomy and relationships. Gill, T. N. 1883.2.

Chiasmodon (*Swallow*). *Natural history and occurrence*. Carte, A. 1866.1. — *In Madeira*. Johnson, J. Y. 1864.1. — *In Indian Ocean*. Smith, H. M. 1901.1. — *Off Portugal*. Wright, E. P. 1868.1.

Family Sphyrænidae

Taxonomy. Bleeker, P. (*Indian Archipel.*) 1854.6; Fowler, H. W. 1903.6.

Sphyræna (*Barracuda*). *Taxonomy. Review, American species*. Meek, S. E. & Newland, R. G. 1885.2.

Fossil in Tertiary of Tyrol. Meyer, C. E. H. 1863.2.

For a monograph on the Barracuda, reviewing the literature and giving many photographic illustrations, see E. W. Gudger, "Sphyræna barracuda; its morphology, habits and history." Pub. no. 252, Carnegie Institution, Washington (Papers Tortugas Laboratory, 1918, 55 p. 7 pls.).

Family Tetragonuridae

Tetragonurus. *Natural history*. Emery, C. 1879.1 (iv).

Taxonomy. Review. Ramsay, E. P. & Ogilby, J. D. Add. 1888.2.

Family Stromateidæ

Taxonomy. Gill, T. N. 1884.2. — *Review, American species.* Fordice, M. W. 1885.1. — *Great Britain.* Holt, E. W. L. & Byrne, L. W. 1903.3. — *Revision.* ★Regan, C. T. 1902.4.

Centrolophus (*Black-fish*). *Natural history and occurrence* — off Massachusetts. Bean, B. A. 1898.2. — in Gulf of Naples. Costa, A. 1871.1. — at New Zealand. Hutton, F. W. 1904.3. — in French waters. Pellegrin, J. 1912.16. — in Firth of Forth. Traquair, R. H. 1902.3.

Cubiceps. *Occurrence in Mediterranean.* Ariola, V. 1904.1, 1912.1; Bonaparte, L. C. 1846.1.

Family Icostidæ " Rag-fishes "

Acrotus. *Occurrence at Port Townsend, Washington.* Bean, B. A. 1898.2; Bean, T. H. 1887.4.

Icichthys. *Occurrence on California coast.* Jordan, D. S. & Gilbert, C. H. 1880.13.

Icosteus. *Description and natural history.* Cohn, L. 1905.1.

Schedophilus medusophagus (*Medusa-eater*). *Natural history and occurrence.* Günther, A. C. (*in Great Britain*) 1885.1; Trois, E. F. 1900.2.

Taxonomy, review. Ogilby, J. D. 1893.3.

Family Ophiocephalidæ

For maps showing the distribution of the Ophiocephalidæ, see Boulenger, G. A. 1904.7 (p. 645), and Meek, A. 1916.1 (p. 310).

Natural history. Köhler, W. 1907.1.

Family Anabantidæ

For maps showing the distribution of the Anabantidæ, see Boulenger, G. A. 1904.7 (p. 645), and Meek, A. 1916.1 (p. 311).

Taxonomy. — *Indian Archip.* Bleeker, P. 1879.3. — *Asiatic species.* Regan, C. T. 1909.2. — *General paper.* Canestrini, G. Add. 1860.1.

Anabas ("Climbing Perch"). *Natural history notes, popular articles, etc.* Boake, B. 1866.1; ★Daldorff, D. C. 1797.1; Dobson, G. E. 1879.1; Harting, P. 1861.1; La Blanchère, P. R. H. 1874.1; Lubach, D. 1864.3; Anon. 697.

For climbing habits and overland progression, see under Locomotion.

SUB-ORDER ANACANTHINI

Taxonomy. Synopsis. Gill, T. N. 1884.3; Regan, C. T. 1903.10. — *Indian species.* Day, F. 1865.2. — *Philippines.* Radcliffe, L. 1913.1. — *Fossil.* Woodward, A. S. 1889.2.

Family Macruridæ

Taxonomy. — *Gulf of Genoa.* Canestrini, G. 1863.1. — *Japan.* Jordan, D. S. & Gilbert, C. H. 1904.1.

Palæontology, otoliths of Austrian Tertiary. Schubert, R. J. 1905.1.

Krohnus filamentosus (*the larval form of Macrurus*), *descriptions.* Costa, A. 1869.1; Emery, C. 1879.1 (ii), 1879.2 (2); Facciola, L. 1882.3.

Macrurus. *Natural history and occurrence.* Fulton, T. W. 1902.1. — *Off British coast.* Holt, E. W. & Byrne, L. W. 1904.1. — *In Norway.* Grieg, J. A. 1910.1. — *In Spain.* Perez Arcas, L. 1872.1, 2.

Taxonomy. — *In Gulf of Genoa.* Vinciguerra, D. 1879.1. — *Antarctic.* Dollo, L. 1900.3.

Family Gadidæ

General treatise. ★Damas, D. 1909.1.

Geographical distribution. Dambeck, K. 1877.1, 1879.1; Redeke, H. C. 1909.1; ★Thompson, D. W. 1910.1, 1911.1, 3, 1912.3.

Natural history. Damas, D. 1909.3; Hoek, P. P. 1911.1; Petersen, C. G. 1902.3.

Spawning ground investigations. ★Schmidt, E. J. 1909.1. — *Spawning conditions and places.* Anon. 327.

Taxonomy and occurrence. — *In Gulf of Genoa.* Canestrini, G. 1863.1. — *Systematic position.* Dietz, P. A. 1912.1. — *Synopsis, North America.* Gill, T. N. 1864.8, 21. — *Synopsis, general.* Kaup, J. J. 1858.3.

Gadus. — *Names.* Brevoort, J. C. 1873.4. — *Taxonomy. Synopsis of species.* Lütken, C. F. 1876.1 (v). — *Bib and Poor Cod distinguished.* McIntosh, W. C. 1886.6, 1888.1. — *Specific characters, with key to species found in northern waters.* ★Williamson, H. C. 1902.1, 1906.1, 1909.1.

Gadus aeglefinus (*Haddock*). *Complete literature, reproduction, development, etc.* Plate of larval forms. ★Hoek, P. 1903.1.

Natural history; North sea. Helland-Hansen, B. 1909.1. — *Comparison American and European specimens.* Welsh, W. W. 1915.1.

Haddock fisheries. Abbs, C. 1792.1; Goode, G. B. & Collins, J. W. 1882.1, 1887.5.

Gadus argenteus. *Natural history.* Fulton, T. W. 1901.1, 1902.1.

Gadus capellanus. *Mediterranean species, structure and taxonomy.* Fage, L. 1911.1.

Gadus esmarkii (*Norway Pout*). *Natural history.* Fulton, T. W. 1901.1; Garstang, W. 1900.4; Holt, E. W. Add. 1892.3.

Gadus merlangus (*Whiting*). *Complete literature of the whiting; reproduction, development, etc.* Plate of larval forms. ★Hoek, P. 1903.1.

Natural history. Cornish, T. 1866.9, 1872.2; Masterman, A. T. 1901.1. — *In glacial clay of Gothland.* Munthe, H. W. 1910.1.

Gadus morrhua (callarius) (Cod). *Complete literature, reproduction, development, etc. Plate of larval forms.* ★Hoek, P. 1903.1.

Natural history and occurrence of the cod. Atwood, N. E. 1859.1, 1865.2, 1866.2; Cobbold, T. S. 1858.1; Cormack, W. E. 1826.1; Day, F. 1879.4, 1880.6; Feddersen, A. F. 1880.2; Fraser, A. 1830.1, 1833.1; Haskell, E. H. 1883.1; ★Masterman, A. T. 1901.1; Reuter, O. O. 1904.1; Spinney, B. H. 1883.1; Wilcox, W. A. 1883.1; Bean, T. H. (in *Alaska*) Add. 1881.1; Koelreuter, J. G. Add. 1777.1.

Researches in North Sea and adjacent waters. Giard, A. & Cépède, C. (spawning grounds) 1907.1; Hartmann, R. 1880.1; ★Helland-Hansen, B. 1909.1. — *Danish waters.* Petersen, C. G. J. 1893.6, 1902.1, .4. — *Coast of Finland.* Sandman, J. A. 1905.3, 1906.1, .4.

Gadus pollachius (Pollack). *Natural history.* Dunn, M. 1887.1, Add. 1885.4; Pelagius, 1877.1; Walbaum, J. J. 1783.1.

Gadus pontassou. *Natural history.* Andrews, W. (*Irish waters*) 1864.1; Fulton, T. W. 1901.1.

Microgadus proximus and tomcod. *Natural history.* Hooper, E. J. (in *California*) 1875.1; Anon. 444.

Lota (Burbot). *General treatise.* Hofer, J. 1894.1.

Natural history, popular accounts, etc. Bean, T. H. 1878.1, 1884.2; Bernhard, C. 1904.1; Day, F. 1880.1; Frost, C. C. 1870.1; Gottberg, G. 1910.2, .4 (in *Finland*) Add. 1912.1; Poulet, J. B. 1879.1; Sander, H. 1788.1; Winkler, T. C. 1860.1; Wood, William 1870.1; Koelreuter, J. G. Add. 1774.1; Baker, H. Pre-Linn. 1748.1.

Occurrence in — *Susquehanna R.* Cope, E. D. 1879.4. — *Cattewater, England.* Hearder, W. 1904.1. — *Switzerland.* Lankester, E. R. 1912.1. — *Finland.* Sandman, J. A. 1896.3. — *Lake Winnipisseogee, N. H.* Storer, D. H. 1844.5, .11. — *Pacific slope waters of North America.* Eigenmann, C. H. Add. 1894.1.

For a map showing the geographical distribution of the fresh-water Lota, see Meek, A. 1916.1 (p. 236).

Merluccius (Hake). — *Occurrence in fresh-water in Denmark.* Feddersen, A. F. 1880.2. — *Fisheries in the United States.* Goode, G. B. & Collins, J. W. 1887.6.

Molva (Ling). *Ling fisheries in Ireland.* Andrews, W. Add. 1861.1.

Occurrence of M. abyssorum — in Iceland and the Faroe Islands. Holt, E. W. L. 1893.2. — *in British waters.* Sim, G. 1897.1.

For a map showing the geographical distribution of the species of the genus Molva, see Meek, A. 1916.1 (p. 236).

Motella (Onus) (Rockling). *Natural history.* Holt, E. W. 1897.3; Le Danois, E. 1913.5; Dunn, M. Add. 1889.1.

Taxonomy. — *Key to species.* Collett, R. 1892.1. — *Synopsis.* Lütken, C. F. 1876.1 (v).

Raniceps (Tadpole-fish). *Taxonomy based on skull structure.* Gill, T. N. 1891.5.

SUB-ORDER ACANTHOPTERYGII

Taxonomy. — *Indian species.* Day, F. 1865.2, 1868.1, 1876.1. — *Synopsis of families.* Günther, A. C. 1862.6. — *Zanzibar.* Playfair, R. L. 1866.1. — *Revision, African species.* Boulenger, G. A. Add. 1909.1. — *Structure and taxonomy, fossil forms.* Woodward, A. S. 1889.2. — *Loricati, taxonomy.* Gill, T. N. 1888.4, 1889.5. — *Percinæ, taxonomy.* Gill, T. N. 1862.29, 1863.1. — *Pharyngognathi.* Cartier, O. (of *Philippines*) 1874.1; Günther, A. C. (of *Zanzibar*) 1866.5. — *Squamipinnes.* Guichenot, A. 1879.1.

DIVISION PERCIFORMES

Natural history. — *General treatise.* Jardine, W. 1835.1, 1861.1.

Taxonomy. Canestrini, G. 1860.1; Fowler, H. W. 1906.8; ★Regan, C. T. 1913.2. — *East Indies.* Bleeker, P. 1849.5, 1862.1. — *Comparison of Percidæ with Scombridæ.* Bonaparte, L. C. 1842.1. — *Review, Cuban forms.* Poey y Aloy, F. 1871.1.

Family Berycidæ

Taxonomy. Boulenger, G. A. 1901.15; Jordan, D. S. & Fowler, H. W. (*Review, Japan*) 1903.1; Regan, C. T. 1911.4, 1912.4.

Aphredoderus (Pirate Perch). *For a map showing the distribution of Aphredoderus, see* Meek, A. 1916.1 (p. 285).

Holocentrum (Squirrel-fish). *Taxonomy — Revision, species from Indian Archip.* Bleeker, P. 1873.18. — *Holocentrum and allied forms.* Fowler, H. W. 1904.4. — *New species from Miocene of Malta.* Woodward, A. S. 1887.4.

Myripristis. — *Fossil form, in Italy.* Bassani, F. 1911.1. — *Taxonomy, revision, Indian Archip.* Bleeker, P. 1873.20.

Family Pempheridæ

Taxonomy, Dutch East Indies. Bleeker, P. 1862.1, 1877.8.

Family Centrarchidæ

Fresh-water Basses and Sunfishes

For a map showing the distribution of the Centrarchidæ, see Meek, A. 1916.1 (p. 285).

General treatises. Engmann, P. 1909.3, 1911.2; ★Harris, W. C. & Bean, T. H. 1905.1.

Nomenclature, scientific names. Gill, T. N. 1877.6. — *Vernacular names, American sunfishes.* Smith, H. M. 1904.4.

Taxonomy. Bollman, C. H. (*Review, North America*) 1892.1; Gill, T. N. (*Synopsis of genera*) 1877.2; Jordan, D. S. 1877.1; McKay, C. L. (*Review*) 1881.1.

Apomotis, Eupomotis and Lepomis (Sunfishes). *Taxonomy.* — *Review, with*

especial reference to Illinois. Richardson, R. E. 1904.1. — *Eupomotis, key to species.* Meek, S. E. 1902.3. — *Lepomis, taxonomy based on pharyngeal dentition.* Bean, B. A. & Weed, A. C. 1911.3.

Kuhlia. *Taxonomy.* — *Review of Kuhlia and related forms; Japan.* Jordan, D. S. & Thompson, W. F. 1912.1. — *Revision.* Regan, C. T. 1913.19.

For a map showing the geographical distribution, see Meek, A. 1916.1 (p. 285).

Micropterus (*Black Bass*). — *Taxonomy.* Gill, T. N. 1873.8. — *General treatise.* ★Henshall, J. A. 1881.1, 1889.1, 1903.1, 1904.2. — *Nomenclature.* Jordan, D. S. 1878.11. — *Natural history.* Reighard, J. E. 1906.1.

Micropterus dolomieu, small-mouthed black bass. — *Original distribution.* Jordan, D. S. 1879.4. — *General treatise.* Loudon, W. J. Add. 1910.1.

Family Lobotidæ

Taxonomy. Gill, T. N. 1882.7. — *Review, Japan.* Jordan, D. S. & Thompson, W. F. 1911.1.

Family Toxotidæ

Taxonomy, East Indian Archip. Bleeker, P. 1862.1, 1876.9.

For a map showing the geographical distribution of Toxotes, see Meek, A. 1916.1 (p. 285).

Family Nandidæ

For a map showing the geographical distribution of the Nandidæ, see Meek, A. 1916.1 (p. 287).

Taxonomy, Indian Archip. Bleeker, P. 1862.1, 1874.9.

Occurrence in Africa. Pellegrin, J. 1906.13.

Family Percidæ

Taxonomy, revision. Jordan, D. S. 1877.1.

Acerina. — *Natural history.* Ehrenbaum, E. 1896.1; Labonté, H. 1905.1. — *Length of habitation of Loire R.* Marchand, E. 1897.1. — *Fossil species, Russia.* Eichwald, C. E. 1873.1.

For a map showing the geographical distribution of Acerina, see Meek, A. 1916.1 (p. 290).

Ammocrypta (*Sand-darter*). *Natural history.* Jordan, D. S. & Copeland, H. E. 1877.2.

Aspro. *Natural history.* Hofer, J. 1908.1; Labonté, H. 1905.1, 1909.1.

Stizostedion (**Lucioperca**) (*Pike-perch or Sander*). *Fisheries in — lakes of Norway.* Huitsfeldt-Kaas, H. 1906.1. — *Germany.* Wiedek, T. 1878.1.

Natural history notes, popular articles, occurrence, etc. Bean, T. H. 1889.15; Bruyère, H. 1909.1; Cheney, A. N. 1896.4, 1897.3; Jeitteles, L. H. 1862.1; Kornhuber, G. A. 1901.3; Lankester, E. R. 1912.1; Le Fort, R. 1909.1; Leonhardt, E. E. 1905.17, 24; Lönnberg, A. J. 1898.3; Maison, E. 1899.2; Mayer, A.

1880.1; Mela, A. J. 1883.3; Nordqvist, O. F. 1905.1, 1906.1; Raveret-Wattel, C. 1889.5; Sachs, T. R. 1879.1; Schaffner, G. 1893.1; ★Supino, F. 1912.2; Anon. 638; Buck, W. O. Add. 1911.1; Langguth, T. G. Add. 1913.2.

Taxonomy and nomenclature. Boulenger, G. A. 1892.4; ★Gill, T. N. 1877.1, 1895.7.

For a map showing the geographical distribution of Lucioperca (Stizostedion), see Meek, A. 1916.1 (p. 289).

Perca (*Perch*). *General treatises.* Henshall, J. A. 1903.1; Anon. 446.

Natural history notes, chiefly Perca flavescens and P. fluviatilis. Keene, J. H. 1879.5, 1881.4; Kendall, W. C. 1906.2; Maison, E. 1905.1; Pollen, F. P. 1871.1, 3; Sailer, E. 1895.1; Schöpf, J. D. 1784.2; Snickt, L. 1896.1; Sundevall, C. J. 1851.3; Vouga, P. 1866.2; Winkler, T. C. 1857.3; Anon. 636; Gronovius, J. F. Pre-Linn. 1744.1.

Variability and variations. Clark-Kennedy, A. 1867.3; Gunn, T. E. 1866.4.

Fossil forms. — *in Tertiary.* Meyer, C. E. (Egypt) 1847.1, (Germany) 1859.4. — *in Oligocene of Germany.* Winkler, T. C. 1880.3. — *P. fluviatilis as a sub-fossil in Sweden.* Sernander, R. 1902.1.

For a map showing the geographical distribution of the genus Perca, see Meek, A. 1916.1 (p. 288).

Sub-family Etheostominae

Natural history, popular accounts of the Darters. Jordan, D. S. & Copeland, H. E. 1876.2; Putnam, F. W. 1872.4.

Taxonomy. — *Southern Appalachians.* Cope, E. D. 1871.10. — *Revision.* Jordan, D. S. 1877.1. — *General review.* ★Vaillant, L. L. 1873.1, 1873.6.

Boleosoma (*Tessellated Darter*). *Natural history and occurrence.* Abbott, C. C. 1874.1; Heimbürger, H. V. 1913.1.

Family Serranidæ

Popular general treatise. ★Harris, W. C. & Bean, T. H. 1905.1.

Taxonomy. Fowler, H. W. 1907.4. — *East Indies.* Bleeker, P. 1862.1. — *Revision.* Bleeker, P. 1876.10. — *Review, America and Europe.* Jordan, D. S. & Eigenmann, C. H. 1890.1. — *Review, Japan.* Jordan, D. S. & Richardson, R. E. 1910.2.

Anthianini of Indian Archip., taxonomy. Bleeker, P. 1873.21.

Sub-family Serraninae

Taxonomy. — *Review, Indian Archip.* Bleeker, P. 1874.7. — *Review, American forms.* Jordan, D. S. & Swain, J. 1885.4. — *General account.* Vaillant, L. L. 1873.4.

Epinephelus (*Grouper*). *Taxonomy.* — *Revision, Indian Archip.* Bleeker, P. 1874.7. — *Revision, Sicily.* Doderlein, P. 1882.1. — *Review, America.* Jordan, D. S. & Swain, J. 1885.4.

Labrax. *Natural history and occurrence.* Mease, J. 1815.1. — *Coast of Sweden.* Schagerström, N. O. 1829.1.

Taxonomy, genus Labrax of Cuvier. Gill, T. N. 1861.4, Add. 1889.3.

Percalates. *In rivers of New South Wales.* Stead, D. G. 1906.3, 1911.2.

Roccus (*R. lineatus*, *Striped Bass*). *Natural history.* Evermann, B. W. 1899.2; Fearing, D. B. 1903.1; Jordan, D. S. 1879.2; Snyder, J. P. 1914.1.

Taxonomy. Gill, T. N. 1861.4.

Fisheries, North Carolina. Worth, S. G. 1889.1.

Serranus. *Natural history notes, descriptions, etc.* Cantraine, F. J. 1835.1; Ferrer y Hernández, J. 1906.1; Harting, P. 1874.3; Rohn, — Add. 1888.1.

Stereolepis (*Jew-fish*). *Taxonomy.* Boulenger, G. A. (*Variations*) 1907.14; Gill, T. N. 1864.6.

Trisotropus. *Taxonomy, review, Cuba.* Poey y Aloy, F. 1870.3.

Sub-family Grammistinae

Taxonomy, East Indies. Bleeker, P. 1862.1.

Rhypticus. *Taxonomy, synopsis.* Gill, T. N. 1862.21.

Sub-family Priacanthinae

Taxonomy. Bleeker, P. 1862.1, 1873.22. — *Review, Japan.* Jordan, D. S. & Thompson, W. F. 1912.1.

Sub-family Centropominae

Taxonomy. Gill, T. N. 1882.6.

Sub-family Pomatominae

Taxonomy. Gill, T. N. 1882.4.

Pomatomus (*Bluefish*). — *Natural history.* Atwood, N. E. 1869.2, 1871.2; Ayres, W. O. 1852.1; ★Baird, S. F. 1873.26; Bean, T. H. 1891.2; Macy, Z. 1893.1. — *Nomenclature.* Gill, T. N. 1883.10.

Sub-family Ambassinæ

Ambassis and **Parambassis**, *revision, Indian Archip.* Bleeker, P. 1874.5.

Sub-family Chilodipterinae (Apogoninae)

Taxonomy. — *Indian Archip.* Bleeker, P. 1874.6. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1901.8. — *Philippine Is.* Radcliffe, L. 1911.1, 1912.1.

Sub-family Lutjaninae

Taxonomy. — *American forms.* Gill, T. N. 1885.4. — *Review, America.* Jordan, D. S. & Swain, J. 1885.6. — *Review, Japan.* Jordan, D. S. & Thompson, W. F. 1911.1.

Aprion. *Revision, Indian Archip.* Bleeker, P. 1873.16.

Etelis. *Synonymy and systematic position.* Gill, T. N. 1863.19.

Lutjanus (*Snapper*). *Taxonomy.* — *Revision, Indian Archip.* Bleeker, P. 1873.16. — *Lutjanus and Neomænis, relationship.* Gill, T. N. 1862.18.

Therapon. *Taxonomy.* — *Review, Indian Archip.* Bleeker, P. 1873.24. — *Revision, Japan.* Jordan, D. S. & Thompson, W. F. 1912.1.

son, W. F. 1912.1. — Revision, Australian species. Ogilby, J. D. & McCulloch, A. R. 1916.1.

Sub-family Cirrhitinae

Taxonomy. Boulenger, G. A. 1896.6; Regan, C. T. 1911.11. — *Revision, Indian Archip.* Bleeker, P. 1875.7. — *Synopsis.* Gill, T. N. 1863.23. — *Review, Japan.* Jordan, D. S. & Herre, A. C. 1907.1.

Sub-family Pentacerotinae

Histioporus and related genera. *Taxonomy, review, Japan.* Jordan, D. S. 1907.5.

Family Anomalopidae

(Doubtfully placed here)

Taxonomy. Weber, M. 1913.1 (pp. 189-191).

Family Pseudochromididae

Taxonomy — *Revision, Indian Archip.* Bleeker, P. 1874.10, 1875.6. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1902.7.

Caulolatilus. *Taxonomy.* — *Synopsis.* Gill, T. N. 1866.6. — *Relationship of Caulolatilus and Latilus.* Gill, T. N. 1881.2. — *Pacific species.* Lockington, W. N. 1881.3.

Lopholatilus (*Tilefish*). *Fisheries.* Collins, J. W. 1883.6; Sherwood, G. H. 1916.1.

Natural history, discovery, disappearance, rediscovery, etc. Bumpus, H. C. 1898.5, 1899.3; ★Collins, J. W. 1884.1; Goode, G. B. & Bean, T. H. (*First description*) 1879.5; Lucas, F. A. 1905.1, Add. 1889.1; Sandman, J. A. 1898.2; Günther, A. C. Add. 1897.1.

Family Cepolidæ

Taxonomy, review, Japan. Jordan, D. S. & Fowler, H. W. 1903.2.

Cepola. *Natural history.* Hilgendorf, F. M. 1890.1; Montagu, G. 1804.1; Thompson, W. 1838.3; Holt, E. W. Add. 1898.2; ★Lütken, C. F. Add. 1883.1.

Family Hoplognathidae (Oplegnathidae)

Taxonomy, review, Japan. Jordan, D. S. & Fowler, H. W. 1902.6.

Family Sillaginidae

Taxonomy. — *Indian Archip.* Bleeker, P. 1874.3. — *Synopsis.* Gill, T. N. 1862.27. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1902.7.

Family Sciænidae

For "singing" by Sciænoid fishes, see under Sound Production.

Taxonomy. — *Indian Archip.* Bleeker, P. 1850.5, 1851.9, 1874.3. — *Revision of North American forms.* Gill, T. N. 1862.20, 1863.7, 1864.2. — *Review, America and Europe.* ★Jordan, D. S. & Eigenmann, C. H. 1889.1. — *Review, Japan.* Jordan, D. S. & Thompson, W. F. 1911.2. — *Fossil remains.* Lörenthey, I. 1911.1. — *Brazil.* Steindachner, F. 1863.2.

Corvina. *Natural history, Chile.* Delfin, F. T. 1901.1.

Cynoscion ("Sea Trout"). *Natural history.* Nakashima, E. 1916.1; ★Gill, T. N. Add. 1911.1; Tracy, H. C. Add. 1908.2.

Haplonotus and Pogonias. *Taxonomy and relationships.* Gill, T. N. 1862.17.

Nebris. *Taxonomy, synopsis.* Vaillant, L. L. 1897.4.

Family Gerridæ

Taxonomy, review, Japan. Jordan, D. S. 1907.4.

Gerres. *Taxonomy, revision, American species.* Evermann, B. W. & Meek, S. E. 1883.1, 1886.1.

Pentaprion. *Taxonomy, revision of genus.* Bleeker, P. 1873.23.

Family Trichodontidæ

Taxonomy, review, Japan. Jordan, D. S. & Snyder, J. O. 1902.7.

Family Pristipomatidæ (Hæmulidæ)

Taxonomy, review, Japan. Jordan, D. S. & Thompson, W. F. 1912.1.

Gnathodentex. *Taxonomy, revision, Indian Archip.* Bleeker, P. 1873.15.

Hæmulon (Grunt). *Taxonomy, review of species.* Jordan, D. S. & Swain, J. 1885.7.

Pentapus. *Taxonomy, revision, Indian Archip.* Bleeker, P. 1873.15.

Pristipoma. *Taxonomy, revision, Indian Archip.* Bleeker, P. Add. 1873.1.

Plectorhynchus. *Taxonomy, revision.* Bleeker, P. Add. 1873.1.

Pomadasy. *Key to Pacific species of tropical America.* Jordan, D. S. & Gilbert, C. H. 1882.2.

Scolopsis. *Taxonomy, Indian Archip.* Bleeker, P. 1873.26.

Family Sparidæ

Taxonomy. — *Sunda-Molucca Archip.* Bleeker, P. 1850.6, 1851.9. — *Review, America and Europe.* ★Jordan, D. S. & Fesler, B. 1893.1. — *Review, Japan.* ★Jordan, D. S. & Thompson, W. F. 1912.1. — *Monograph, Cuba.* Poey y Aloy, F. 1874.1. — *Limits of family.* Troschel, F. H. 1849.1.

Archosargus, Diplodus and Lagodon. *Taxonomic review, American species.* Eigenmann, C. H. & Hughes, E. G. 1887.1.

Cæzio. *Taxonomy, revision, Indian Archip.* Bleeker, P. 1873.17.

Calamus. *Taxonomy.* — *Revision.* Guichenot, A. 1868.2; Jordan, D. S. & Gilbert, C. H. 1885.5.

Chrysophrys and Sargus. — *Taxonomy, revision.* Bleeker, P. 1877.12. — *Fossil teeth.* Costa, O. G. 1863.1.

Dentex. — *Taxonomy, revision, Indian Archip.* Bleeker, P. 1873.15. — *Natural history and occurrence.* Holt, E. W. &

Byrne, L. W. 1905.2; Trois, E. F. Add. 1886.1. — *In Pliocene of Volterra.* Meneghini, G. 1864.1–1866.1.

Gymnocranius and Synagris. *Taxonomy, review, Indian Archip.* Bleeker, P. 1873.15.

Lethrinus. *Taxonomy, revision, Indian Archip.* Bleeker, P. 1873.19.

Mæna and allied forms. *Taxonomy, Indian Archip.* Bleeker, P. 1850.3, 1851.9.

Pagellus. *Taxonomy, revision.* Guichenot, A. 1868.2.

Pagrus. — *Taxonomy, Japanese species.* Kishinouye, K. 1901.1. — *Fisheries,* Kishinouye, K. 1902.2. — *Natural history.* Nishikawa, T. 1904.2. — *Sub-fossil at Melbourne.* Dames, W. B. Add. 1890.1.

Sparus. — *Nomenclature.* Gill, T. N. 1882.3. — *Natural history.* Schousboe, P. Add. 1797.1.

Stenotomus (Scup). *Natural history.* Baird, S. F. 1873.26.

Family Mullidæ

Taxonomy. — *Revision, Indian Archip.* Bleeker, P. 1875.5. — *American species.* Hall, E. A. & McCaughan, J. Z. 1886.1. — *Japan.* Snyder, J. O. 1907.1.

Mullus (Red Mullet). *Natural history.* Fulton, T. W. 1902.1; ★Lo Bianco, S. 1908.2.

Family Caproidæ (Antigoniidæ)

Relationships. Starks, E. C. 1902.1.

Family Chaetodontidæ

Taxonomy. — *East Indies.* ★Bleeker, P. 1850.1, 1862.1, 1877.4, 1877.9. — *Review, North American species.* Eigenmann, C. H. & Horning, J. E. 1887.1. — *Review, Japan.* ★Jordan, D. S. & Fowler, H. W. 1902.2. — *General paper.* Kaup, J. J. 1860.5.

Chaetodon. — *Taxonomy.* Bleeker, P. 1876.6; Boddaert, P. 1770.1, 1772.2. — *Natural history.* Mitchell, J. 1828.1; Walbaum, J. J. Add. 1779.2.

Ephippus and allied forms. *Affinities based on osteology.* Gill, T. N. 1882.2.

Holacanthus. *Taxonomy, review, Queensland.* Ogilby, J. D. 1915.2.

Scatophagus and allies. *Taxonomy and affinities, based on osteology.* Gill, T. N. 1891.2.

Family Teuthididæ (Siganidæ)

Taxonomy. — *Sunda-Molucca Archip.* Bleeker, P. 1850.7. — *Synopsis of genera.* Gill, T. N. 1885.5. — *Relationships.* Starks, E. C. 1907.1.

Teuthis (Tang or Lancetfish). — *Nomenclature.* Gill, T. N. 1896.16. — *Taxonomy, review, American species.* Meek, S. E. & Hoffmann, M. L. 1885.1.

Family Osphromenidæ

For a map showing the geographical distribution of the Osphromenidæ, see Meek, A. 1916.1 (p. 312).

Taxonomy. Bleeker, P. (*Indian Archip.*) 1879.3; Brüning, C. 1905.3.

Betta (*Fighting-fish*). *Natural history accounts.* Bause, B. 1897.1; Träber-Klotsche, G. 1912.4; Hipler, J. Add. 1914.1.

For fighting habits of Betta pugnax, see under Habits.

Osphromenus (*Gourami*). — *Natural history.* Artaud, J. B. L. 1821.1, 1829.1; Cavenne, — 1827.1; ★Dabry de Thiersant, P. 1870.1; Feddersen, A. F. 1878.3; ★Gill, T. N. 1874.3; Hardwicke, T. 1829.1; Melnikov, V. S. 1902.2; Pearson, J. 1911.1; Sauvage, H. E. 1874.3. — *Distribution.* Senoner, A. 1870.1.

Polyacanthus (**Macropodus**) (*Paradise Fish*). *Natural history, popular accounts, descriptions, etc.* Boulart, R. 1872.1; Brüning, C. 1904.1; ★Carbonnier, P. 1869.1, 1870.1, 2, 1872.1, 3, 1880.1; Dubois, A. 1874.1; Grochowski, M. 1902.1; Joly, N. 1872.1, 2, 1874.1; Lamarche, C. 1899.1; Lefebvre, A. 1877.1; Lubach, D. 1873.1; Anon. 340.

Trichogaster. *Natural history.* Arnold, J. P. 1912.29; Melnikov, V. S. 1902.2, 1903.1.

Family Embiotocidæ

Surf Fishes

General treatise. ★Eigenmann, C. H. 1894.4.

Taxonomy. Californian forms. (Original definition.) Agassiz, J. L. 1853.4, 1854.1, 1861.1; Eigenmann, C. H. & Ubrei, A. B. 1894.1; Gibbons, W. P. 1854.1; Girard, C. F. 1856.7, 9, 1890.2. — *Review, Japanese species.* Jordan, D. S. & Sindo, M. 1902.1.

Family Cichlidæ (Chromidæ)

For maps showing the distribution of the Cichlidæ, see Boulenger, G. A. 1904.7 (p. 672), and Meek, A. 1916.1 (p. 313).

General treatises. — Popular. Engmann, P. 1911.1, 1912.1. — *Scientific monograph.* ★Pellegrin, J. 1904.2.

Taxonomy and distribution. Agassiz, J. L. 1858.8. — *Revision, Africa and Syria.* Boulenger, G. A. 1898.16, Add. 1909.1; Lortet, L. 1883.1. — *South American species.* Eigenmann, C. H. & Bray, W. L. 1894.1; Eigenmann, C. H. & Kennedy, C. H. 1903.1; Haseman, J. D. 1911.1; Steindachner, F. (*Amazon R.*) 1875.1. — *Central America.* Kner, R. & Steindachner, F. 1864.1, 1870.1; Steindachner, F. 1864.1.

Acara, Nannacara, Acaropsis and Astronotus. *Taxonomy, revision.* Regan, C. T. 1905.15.

Cichla, Chaetobranchus and Chaetobranchopsis. *Revision.* Regan, C. T. 1906.11.

Cichlasoma and allied genera. *Taxonomy, revision.* Regan, C. T. 1905.13.

Crenicichla, Crenacara and Batrachops. *Taxonomy. — Revision.* Regan, C. T. 1905.16. — *Synopsis, Crenicichla.* Regan, C. T. 1913.21.

Geophagus, Biotæcus, Heterogramma and Retroclus. — *Taxonomy.* Engmann, P. 1903.1. — *Revision.* Regan, C. T. 1906.12.

Heros. *Natural history.* Melnikov, V. S. 1902.1.

Ptychochromis. *Taxonomy, synopsis.* Pellegrin, J. 1907.15.

Family Pomacentridæ

Taxonomy. — Indian Archip. ★Bleeker, P. 1877.3. — *Synopsis, North America, west coast.* Gill, T. N. 1864.22. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1902.5.

Family Labridæ

Wrasses

Taxonomy. — Indo-Australian Archip. ★Bleeker, P. 1847.1, 1849.8, 1862.1, 2, 10. — *Mediterranean.* Canestrini, G. 1868.1. — *North America.* Gill, T. N. 1864.15. — *France.* ★Gouret, P. 1893.1. — *Synopsis of genera.* Günther, A. C. 1861.12. — *Brazil.* Heckel, J. J. 1840.1. — *Hawaiian Is.* Jenkins, O. P. 1901.2. — *Review, America and Europe.* ★Jordan, D. S. 1891.6. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1902.5. — *General account.* Kner, R. 1860.5. — *Europe.* Degland, C. D. Add. 1839.1.

Taxonomy, fossil forms. Cocchi, I. 1864.1, 1865.1; Eastman, C. R. 1904.5.

Chærops. *Nomenclature.* Gill, T. N. 1908.1; Ogilby, J. D. 1909.1.

Labrus. *Natural history notes.* Bellamy, J. C. 1845.1; Diorio, V. 1869.1; Carlisle, A. Add. 1831.1.

Labrichthys and **Pseudolabrus.** *Structure and taxonomy.* Gill, T. N. Add. 1891.2.

PlatyGLOSSUS and related genera. *Taxonomy, review, American forms.* Jordan, D. S. & Hughes, E. G. 1887.2.

Family Scaridæ

Parrot Wrasses

Taxonomy, Indian Archip. Bleeker, P. 1861.4, 1862.1. — *Catalogue, specimens in Paris Museum.* Guichenot, A. 1865.1. — *Hawaiian Is.* Jenkins, O. P. 1901.2. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1902.5. — *West Indian forms.* Jordan, D. S. & Swain, J. 1885.2.

DIVISION SCOMBRIFORMES

Taxonomy. Bleeker, P. (*Sunda-Molucca Archip.*) 1851.9; Fowler, H. W. 1904.5; ★Regan, C. T. 1909.13.

Family Carangidæ

Taxonomy. — General synopsis. Gill, T. N. 1883.9. — *Synopsis, North America.* Gill, T. N. 1863.22. — *Review, American forms.* Jordan, D. S. & Gilbert, C. H. 1884.6. — *United States.* Goode, G. B. 1882.1. — *Catalogue, Paris Museum.* Guichenot, A. 1865.2. — *Queensland.* Ogilby, J. D. 1915.1. — *Relationships.* Starks, E. C. 1911.5.

Naucrates (*Pilotfish*). — *In freshwater*. Moore, E. 1842.1. — *Early description*. Osbeck, P. Pre-Linn. 1755.1.

Trachynotus (*Pompano*). *Taxonomy, review, American species*. Meek, S. E. & Goss, D. K. 1885.2.

Family Rhachicentridæ (Elacatidæ)

Taxonomy. Gill, T. N. 1888.1.

Rhachicentron (**Elacate**) (*Cobia or Crab-eater*). — *Natural history, young*. Bean, T. H. 1888.5; Fisher, A. K. 1891.1; Osburn, R. C. 1911.12. — *Nomenclature*. Gill, T. N. 1896.5.

Family Scombridæ

Taxonomy. Gill, T. N. 1863.8, 17. — *Italy*. Damiani, G. 1909.1. — *Review, America and Europe*. Dresslar, F. B. & Fesler, T. 1889.1. — *Japan*. Kishinouye, K. 1893.1; Kitahara, T. 1897.1. — *Scotland*. Walker, R. 1874.2. — *Relationships*. Starks, E. C. 1909.1, 1910.1.

Cybius (**Scomberomorus**) (*Spanish Mackerel*). — *Fossil forms, Tertiary of Belgium*. Demenge, E. 1897.1; Storms, R. 1892.1, 1895.1. — *Natural history*. Earll, R. E. 1883.2. — *Taxonomy, revision, American species*. Meek, S. E. & Newland, R. G. 1885.1. Poey y Aloy, F. 1879.1.

Gymnosarda (*Little Tunny*). *Fisheries, in Japan*. Okamura, K. & Marukawa, H. 1909.1.

Scomber (*Mackerel*). *Complete literature, reproduction, development, etc. Plate of larval forms*. ★Hoek, P. 1903.1.

Natural history. Badham, C. D. 1853.1; Bullen, G. E. 1913.1; Cligny, A. 1906.2; Couch, J. 1844.2; Couch, R. Q. 1844.1, 1851.3; Dunn, M. 1893.1; ★Ehrenbaum, E. 1905.3, Add. 1914.2; Goode, G. B. 1884.5; Gunner, J. E. 1770.1; Herdman, W. A. 1913.2; Lönnberg, A. J. 1907.7; Moore, P. 1899.1; Marion, A. F. 1894.6, Add. 1889.3; Nilsson, D. 1914.1; Sandman, J. A. 1899.2; Anon. 646; Holt, E. W. Add. 1892.6; Deslandes, A. F. Pre-Linn. 1724.1; Gronovius, J. F. Pre-Linn. 1744.1. — *Variations, races, and migrations*. ★Garstang, W. 1897.3, 1898.1, Add. 1897.1.

For a map showing the geographical distribution of Scomber scombrus, see Meek, A. 1916.1 (p. 319).

Thynnus (**Orcynus**) (*Tunny or Tuna*). *Biology and fisheries in the Mediterranean*. ★Sanzo, L. 1910.2; Amico, F. C. Add. 1816.1; Roule, L. Add. 1914.1.

Natural history notes, descriptions and occurrences. Collett, R. 1879.1; Day, F. 1886.2; Collett, R. 1882.1; Jackson, J. B. 1844.1; Lönnberg, A. J. 1907.7; McIntosh, W. C. 1886.1; Schulze, F. E. 1903.1; Walker, R. 1874.2; Anon. 716; Cunningham, J. T. Add. 1895.3.

Nomenclature. Gill, T. N. 1894.3, Add. 1888.4; Jordan, D. S. 1889.5.

Fossil forms from — Oligocene of Rumania. Simionescu, J. T. 1906.2. — *Pliocene of Belgium*. Storms, R. 1889.1. — *Tertiary of Suffolk*. Woodward, A. S. 1890.1.

cene of Belgium. Storms, R. 1889.1. — *Tertiary of Suffolk*. Woodward, A. S. 1890.1.

Family Trichiuridæ (Lepturidæ)

Taxonomy. Gill, T. N. (*Synopsis*) 1864.19; Regan, C. T. 1909.13.

Lepidopus (*Frostfish*). *Natural history and occurrence — in New Zealand*. Arthur, W. 1884.2. — *in Dublin Bay*. Ball, Robert. 1855.1. — *in Finmarken, Norway*. Collett, R. 1913.1. — *in market of Naples*. Costa, A. 1868.1. — *in Gulf of Quarnero, Italy*. Ninni, A. P. 1862.1. — *in Norway*. Grieg, J. A. 1913.1.

Taxonomy, first description. Goüan, A. 1770.1.

Ruvettus (*Escolar*). *Mode of capture at Funafuti*. David, (Mrs.) T. W. Add. 1899.1; Hedley, C. Add. 1897.1.

For the purgative effects of the oil of this fish, see under Economic Products, under Fisheries.

Trichiurus (*Cutlassfish, Scabbardfish, Hair-tail*). *Occurrence. — on English coast*. Clogg, S. 1871.1; Cornish, T. 1867.4, 1871.2, 1872.5; Gatcombe, J. 1871.1. — *on coast of Scotland*. Edwards, T. 1876.1; Hoy, J. 1815.1. — *in Portugal*. Holten, H. S. 1802.2. — *in French waters*. Vaillant, L. L. 1897.6.

Family Histiophoridæ

Sailfishes

General treatise. Goode, G. B. 1883.7.

Taxonomy. Kampen, P. N. (*Java*) 1908.1; Regan, C. T. 1909.13.

Histiophorus. *Natural history, popular accounts, etc.* Barnes, W. M. 1883.1; Broussonet, P. M. A. 1786.2; Diaz y Martinez, E. 1910.2; Hector, J. 1869.1; Osburn, R. C. 1910.7; Ramsay, E. P. 1881.4; Rea, P. M. 1909.1; Anon. 492. *Taxonomy*. ★Lütken, C. F. 1874.1 (iv), 1876.2, 1877.3. — *H. herschelli compared with Xiphias gladius*. Hector, J. Add. 1898.1.

Fossil forms, structure and taxonomy. Marsh, O. C. 1870.1. — *In Pliocene of Siena Prov., Italy*. ★Barbolani di Montauto, G. Add. 1910.1.

Tetrapturus. *Taxonomy and occurrence*. Canestrini, G. 1861.6. — *Madeira Is.* Lowe, R. T. 1840.1. — *In Adriatic*. Trois, E. F. 1880.1.

Family Palæorhynchidæ

Eocene, Miocene and Pliocene

Classification. Regan, C. T. 1909.13.

Hemirhynchus. *Occurrence, structure and taxonomy. — At Puteaux, France*. Gervais, F. L. P. 1872.2; Meunier, S. 1872.1. — *Taxonomy*. Kner, R. 1867.2.

Palæorhynchus. *Occurrence. — at Puteaux, France*. Gervais, F. L. P. 1872.2; Meunier, S. 1872.1. — *in Eocene of Italy*. Pasquale, M. 1904.1.

Family Xiphiidæ

General treatise. Goode, G. B. 1883.7. *Nomenclature*. Gill, T. N. 1883.4.

Taxonomy and distribution. Goode, G. B. 1882.5; Regan, C. T. 1909.13.

Xiphias (Swordfish). *Natural history notes, miscellaneous accounts, descriptions, occurrences.* Bureau, L. 1895.1; Cheeseman, T. F. 1876.1; Friedel, E. 1880.3; Holder, C. F. 1876.1; Koelpin, A. B. 1770.1, Add. 1775.1; Knox, F. J. 1870.1; Lanman, C. 1881.1; Münter, J. A. 1876.1; Schnee, S. 1903.3; Sprenger, W. 1900.8.

Swordfish fisheries. Osburn, R. C. 1912.7; Anon. 311. — *United States.* Clark, A. H. 1886.1; Goode, G. B. 1887.2; — *Italy.* Mazzullo, L. 1906.1; ★Mercadante, L., Jannaci, F. & Adorno, M. 1906.1; Brydone, P. Add. 1806.1; Ray, J. Pre-Linn. 1673.1; Silos, G. Pre-Linn. 1683.1.

Pre-Linnæan refs. to the Swordfish. Hannæus, G. 1690.1; Hanow, M. 1737.1; Larren, J. 1707.1; Warren, G. 1667.1.

For swordfishes attacking vessels, and fighting whales, see under Predatory fishes.

Family Luvaridæ

Classification. Regan, C. T. 1909.13.

Luvarus (Ausonia). *Natural history and occurrence.* Collenette, A. 1904.1; Holder, C. F. 1901.1. — *At Falmouth.* Bullmore, W. K. 1863.1, 1866.1. — *On Irish coast.* Constable, W. J. 1911.1. — *On coast of Cornwall.* Cornish, T. 1866.1. — *At Malta.* Gulia, Giovanni. 1910.1. — *At Venice.* Ninni, E. 1900.1. — *On south coast of Ireland.* Scharff, R. F. 1901.1. — *In Adriatic Sea.* Trois, E. F. 1867.2, 1909.1. — *On coast of Finistère, France.* Vaillant, L. L. 1895.4; Delage, Y. Add. 1914.1.

Family Coryphænidæ

Taxonomy. Cocco, A. 1886.1.

Coryphæna (Dolphin). *Early description.* Ankarkrona, T. Pre-Linn. 1740.1.

Family Bramidæ

Brama (Pomfret). — *Natural history.* Collin, J. 1874.1; Künstler, J. & Chaine, J. 1906.3. — *Taxonomy, revision.* Lunel, G. 1865.1.

Pterycombus. *Natural history.* Lilljeborg, W. 1864.1; Shufeldt, R. W. 1912.2.

DIVISION ZEORHOMBI

Family Zeidæ

Taxonomy and relationships. Cligny, A. 1912.7; Starks, E. C. 1898.2.

Zeus (John Dory). *Natural history notes.* Kner, R. 1865.5; Rasch, H. H. 1871.1; Lennier, G. Add. 1895.1.

Oreosoma (A genus founded on young of a fish allied to *Cyttus*). *Taxonomy and relationships.* Boulenger, G. A. 1903.16; Vaillant, L. L. 1893.2.

Family Amphistidæ

For *Amphistium paradoxum* from the Upper Eocene, see Woodward, A. S. 1889.2 (vol. 4, pp. 434, 435).

FAMILY PLEURONECTIDÆ

Used in the inclusive sense, equivalent to the suborder Heterosomata, including the Pleuronectidæ and Soleidæ, and the numerous other forms recently elevated to family rank. This arrangement is adopted by us as a matter of convenience in citation rather than as any expression of taxonomic relationships.

As articles on the Pleuronectidæ are, in nearly every case, inclusive in their treatment, the citations under the various sub-divisions below will be found to overlap each other greatly as to actual subject matter.

Summary of literature on Dab, Sole, and Turbot. ★Hoek, P. 1903.1.

Summaries of literature on the Plaice. Duncker, G. 1895.1, 2, 1896.1; Herdman W., Scott, A., Johnstone, J. & Cole, F. 1902.1; ★Hoek, P. 1903.1.

Detailed descriptions of the various species. Fries, B., Eckstrom, C. & Sundevall, C. 1836.1, (English trans.) 1893.1; Krøyer, H. N. 1838.1; Day, F. 1880.2; Günther, A. 1859.1.

Briefer diagnoses of the species. Möbius, K. & Heincke, F. 1883.1.

NATURAL HISTORY

Chiefly comprehensive accounts, including in some cases short references to subjects treated in detail in the sections below. Baldwin, A. H. 1863.1, 1879.1; Cunningham, J. T. 1894.1; Fulton, T. W. 1905.3; Lönnberg, A. J. 1894.6; ★Redeke, H. C. 1909.2; Anon. 449; Cockerell, T. D. Add. 1890.1.

Arnoglossus laterna and **thori.** Holt, E. W. Add. 1892.1, 1897.2.

Hippoglossus vulgaris (Halibut). Goode, G. B. 1885.2; ★Thompson, W. F. 1915.1; Ehrenbaum, E. Add. 1914.4; Holt, E. W. Add. 1892.4.

Pleuronectes (**Glyptocephalus**) **cy-noglossus** (Witch). *On coast of North America.* Goode, G. B. & Bean, T. H. 1878.1.

Pleuronectes flesus (Flounder). Ascroft, R. L. 1900.2; Braun, M. G. 1880.1; Collin, J. 1876.1; Ehrenbaum, E. 1911.6; ★Herdman, W. A., Scott, A. & Johnstone, J. 1890.1; Sandman, J. A. 1906.1, 4.

Pleuronectes limanda (Dab). Petersen, C. G. 1893.3.

Pleuronectes (**Glyptocephalus**) **microcephalus** (Lemon Dab). Holt, E. W. Add. 1893.4.

Pleuronectes platessa (Plaice). Apstein, C. 1894.1–1905.1; Brüssow, — 1879.1; ★Cole, F. J. & Johnstone, J. 1901.1; Cunningham, J. T. 1895.2, 3; Faber, F. 1828.2; ★Garstang, W. 1905.4, .6, 1909.1; ★Johansen, A. C. 1905.1, 1909.1, 1910.1, 1912.1; Malard-Duméril, — 1898.1; ★Gilson, G. Add. 1910.1; Hannemann, B. J. Pre-Linn. 1698.1. — *Putnam's flat fish, a smooth Plaice.* Bean, T. H. 1879.12. — *Vitality of trawl-caught plaice.* Borley, J. O. 1909.2.

Rhombus maximus (Turbot). Day, F. 1880.9; Goode, G. B. 1880.19; Le-

vander, K. M. 1897.3; Sandman, J. A. 1906.4; Holt, E. W. Add. 1892.5.

Solea vulgaris (Sole). ★Cunningham, J. T. 1890.2; Houghton, W. 1883.1; ★Redeke, H. C. & Tesch, J. J. 1911.1; ★Ehrenbaum, E. Add. 1914.5; Green, W. S. Add. 1890.1. — *Eggs of sole attached to shrimp*. Deslandes, A. F. Pre-Linn. 1724.1, 1753.1; Needham, J. T. Pre-Linn. 1745.1.

AMBICOLORATION

Being the partial or complete development of pigmentation on the eyeless and ordinarily colorless side.

For adjustment in coloration to the surroundings and effects upon coloration of extirpation of the eyes, see under Coloration.

General accounts and summaries of various theories as to cause. Bateson, W. 1894.2, 1895.1; ★Gemmell, J. F. 1912.1; ★Hussakof, L. 1914.3.

Records of Occurrence of Ambicolorate Specimens

Chiefly the flounder, plaice, sole, and turbot, and including partially ambicolored or "piebald" specimens. Bos, J. R. 1886.1; Elmhirst, R. 1911.1; Filhol, H. 1889.1; Johnstone, J. 1909.1; Nicols, A. 1873.1; Pouchet, G. 1892.1; Ritchie, J. 1908.1; Rodd, E. H. 1862.1; Sacchi, M. 1898.1; Schleep, B. C. 1829.1; Toni, E. 1888.1; Trois, E. F. 1908.1, 1909.2. — *No change in coloration after extirpation of eyes.* Buijtendijk, F. J. J. 1911.1. — *Platessa oblonga with both sides equally colored.* Storer, D. H. 1844.10, 1855.1.

Cases of inversion of coloration, i. e., absence of pigmentation on ocular side and appearance of color below. Noury, E. 1909.1; Sacchi, M. 1899.1, 2. — *Engyophrys, normally pigmented on blind side.* Jordan, D. S. & Bollman, C. H. 1890.1.

Theories of causation

Ambicoloration caused by abnormal movements in swimming. Giard, A. 1892.3. — *This view contradicted by aquarium experiments of Cuénot, L. 1905.1, 1906.1; and Cunningham, J. T. 1895.1.*

Ambicoloration in flatfishes a case of atavism. Kent, W. S. 1873.3. — *Contradiction of Kent's theory. Suggestion of crossing of normal and reversed specimens as cause of ambicoloration.* Romanes, G. J. 1873.1.

Experiments on action of light on the under side of flatfishes. ★Cunningham, J. T. 1891.3, 1893.1, 10; Cunningham, J. T. & MacMunn, C. A. 1893.1. — *Experiments on flatfishes living on slaty bottom.* Cunningham, J. T. 1895.1.

Theories deduced from the above and other experiments with light. — *Ambicoloration due (at least in part) to the penetration of light through shallow water to the parts of the fish not in contact with the hard bottom.* ★Cunningham, J. T. 1894.1; Hussakof, L. 1914.3. — *Ambicoloration probably due to influence of sympathetic nervous system as well as action of light.* McIntosh, W. C. 1902.2, 3.

DEVELOPMENT

Including metamorphosis of the bilateral larvæ to the asymmetrical conditions of the adult. The subdivisions, "Asymmetry" and "Rotation of eye" are retained for convenience although these subjects are not readily separable.

Eggs and Larvæ

"The eggs of the Pleuronectidæ, like those of the Gadoids, are pelagic or floating, and the species begin life with a denatant drift in the current from deep to shallow water." Meek (A. 1916.1, p. 262).

This subject has been studied chiefly by means of the results of fishery investigations. For detailed reports and statistics, see the Reports cited below under Migrations. See also under Fisheries.

Descriptions of eggs of various Pleuronectidæ. Cunningham, J. T. 1888.1; Holt, E. W. 1891.5, 1893.4. — *Plaice eggs.* McIntosh, W. C. & Prince, E. E. 1890.1.

Eggs and larvæ in the North Sea. ★Ehrenbaum, E. 1897.1, 1908.2, 1910.1, 2, 1911.3; Bowman, A. (Plaice) Add. 1914.1.

Statistics of number of Plaice eggs — in Baltic. Hensen, V. & Apstein, C. 1897.1. — *in Loch Fyne.* Williamson, H. C. 1899.1.

Plate of larval forms. ★Hoek, P. 1903.1. *Spawning areas (chiefly North Sea and coasts of Ireland and Scotland).* Meek, A. 1916.1.

General papers on the eggs and larvæ of Pleuronectidæ, including their distribution, quantity, development, etc. Kyle, H. M. 1900.7; McIntosh, W. C. 1892.2, 1894.2, 1895.1; ★Petersen, C. G. 1904.2, 4, 1906.2, 1909.2. — *Zeugopterus punctatus.* Cunningham, J. T. 1893.11. — *Rhomboidichthys mancus.* Facciola, L. 1887.3. — *Pleuronectes cynoglossus.* Holt, E. W. & Byrne, L. W. 1903.2. — *Arnoglossus and Hippoglossus.* Williamson, H. C. 1911.2, 4.

Post-larval Stages

Chiefly metamorphosis. Papers treating in detail of this stage. ★Apstein, C. 1894.1, 1897.1, 1905.1; Kyle, H. M. 1898.1; McIntosh, W. C. 1888.3, 1889.2, 1896.4; Schmidt, E. J. 1904.2; Williamson, H. C. 1904.1.

Natural history and rate of growth of young plaice after metamorphosis is complete. Cunningham, J. T. 1896.1. — *Recent detailed account.* ★Fulton, T. W. 1902.3.

Asymmetry of flatfishes

References to Asymmetry will also be found in many of the other articles cited in this section, particularly those under Ambicoloration, Rotation of Eye, and Post-larval stages.

First correct explanation of the asymmetry of the Pleuronectidæ. ★Traquair, R. H. 1865.1, 1865.2.

Nature and development of the asymmetrical condition, structural changes, etc. Autenrieth, J. H. 1800.1; Beneden, P. J. 1853.3; Crichton-Browne, J. 1907.1; ★Cunningham, J. T. 1896.1; ★Duncker,

G. 1900.2; Fullarton, J. H. 1891.1; ★Fulton, T. W. 1902.3; Malm, A. W. 1854.1, 1868.1, 1880.1; Marshall, W. A. 1885.1; Masterman, A. T. 1910.1, 1912.1; Pfeffer, G. J. 1886.1; Reichert, C. B. 1873.1; Sacchi, M. 1893.1, 1894.1; Steenstrup, J. J. 1863.1, 1864.3-1865.1, 1866.2; Steiner, J. 1886.1, 4; Thomson, C. W. 1865.1; Wright, E. P. 1878.1.
Structure of the optic chiasma in asymmetrical fishes. Mayhoff, H. 1912.1; ★Parker, G. H. 1903.2; Williams, S. R. 1902.1.

Rotation of eyes

The change of the eyes of the larval flatfish during growth or metamorphosis from a bilateral condition to approximation on one side of the head, with the accompanying changes in the optic tract, cranial skeleton, etc.

As first enunciated by Traquair, the whole of the cranium in the region of the orbit has rotated on its longitudinal axis.

Various papers. ★Agassiz, A. 1876.1, 1877.2, 1878.1 (ii), 1879.3; Behr, A. 1899.1; ★Ehrenbaum, E. 1897.1 (i); ★Facciola, L. 1885.2, 1887.3, 1901.1; Harting, P. 1866.2, 1878.5; Hawkes, A. J. 1907.1; ★Mayhoff, H. 1914.1; Nishikawa, T. 1897.1; ★Parker, G. H. 1903.2; Pfeffer, G. J. 1894.2; Provazek, F. 1900.1; Schjødte, J. M. 1868.1, 1877.1; Thilo, O. 1902.3, 4, 1908.1; ★Williams, S. R. 1901.1, 1902.1; Wright, E. P. 1879.1; Anon. 359; Hanow, M. Pre-Linn. 1737.1.

Views of Steenstrup who believed that one eye passed through the substance of the head. ★Steenstrup, J. J. 1866.2, 1876.1.

Records of cases of arrested rotation of the eyes, teratological conditions resulting in complete or partial retention of bilateral symmetry, often accompanied by other minor abnormalities in coloration, etc. Filhol, H. 1889.1; Giard, A. 1892.3; Holt, E. W. 1893.2; Johnstone, J. 1909.1; Ninni, E. 1906.1; Ritchie, J. 1908.1; Sacchi, M. 1898.1; Schleep, B. C. 1829.2; Storer, D. H. 1844.10.

*Teratological specimens showing a reversal of the eye position, i. e., the occurrence of both eyes on the opposite side of that normal for the species. Specimens of — Turbot (*Psetta maxima*).* Cunningham, J. T. 1907.1. — *Flounder.* Traquair, R. H. 1900.3.

DISTRIBUTION

Predominantly Northern

For distribution of eggs and larvæ, see also the articles cited above under Eggs and Larvæ.

For areal and bathymetric distribution, see particularly Cunningham, J. T. 1896.1; Day, F. 1880.2; Fulton, T. W. 1893.2; ★Hoek, P. 1903.1 (*Plaice, Sole, and Dab*); Holt, E. W. 1893.1; Johansen, A. C. 1905.1; ★Meek, A. 1916.1.

Bathymetric distribution. Herdman, W. & Dawson, R. 1902.1; Schiemenz, P. 1902.1.

Distribution in Arctic waters. — *Alaska; Halibut.* Bean, T. H. 1879.10. — *Murman Coast and White Sea.* Knipovich, N. M. 1901.1, 1902.1. — *Behring Sea, Alaska and Sea of Okhotsk, and White Sea; Plaice.* Smitt, F. A. 1893.1.

Baltic Sea. Möbius, K. & Heincke, F. 1883.1. — *Plaice in Baltic.* Duncker, G. 1904.2; Krüger, Albert. 1903.1, 1904.1; Mortensen, O. T. J. 1895.1; Reibisch, J. 1904.1, 1907.1, 1911.1. — *Effect of low specific gravity on plaice distribution in Baltic.* Hensen, V. A. 1884.1; Petersen, C. G. 1894.1. — *Dab.* Schiemenz, P. 1902.1.

Distribution on coast of Finland. — *Plaice.* Fischer, J. 1875.1. — *Dab.* Malmgren, A. J. 1863.1. — *Halibut.* Sandman, J. A. 1906.1.

English coast. — *Hippoglossus vulgaris.* Holt, E. W. & Byrne, L. W. 1904.1; Kermode, P. M. 1897.1.

Germany. *Flounder.* — in *Upper Rhine.* Lauterborn, R. 1906.1. — in *Main R.* Thienemann, A. 1912.7.

Irish Sea and vicinity. Herdman, W. & Dawson, R. 1902.1; Holt, E. W. 1891.5. — *Firth of Clyde.* Scott, T. 1900.1.

Italian coast. — *Gulf of Genoa.* Canestrini, G. 1861.4. — *Adriatic Sea, Plaice.* Trois, E. T. 1878.3. — *Sea of Messina, Arnoglossus.* Facciola, L. Add. 1886.1.

North America. Bumpus, H. C. 1898.6; Goode, G. B. & others. 1887.1. — *Turbot and Sole.* Goode, G. B. 1880.19.

North Sea and North Atlantic. — *North Sea.* Fulton, T. W. 1905.3, 1913.1.

Plaice in North Sea. Bowman, A. Add. 1914.1; Garstang, W. 1909.2. — "Proportionate distribution of the sexes of plaice in the North Sea." Hefford, A. E. 1909.1.

Icelandic waters. — *Dab.* Ehrenbaum, E. 1901.2. — *Plaice.* Faber, F. 1829.1.

East coast of Scotland. McIntosh, W. C. & Masterman, A. T. 1897.1. — *Firth of Forth.* Cunningham, J. T. 1896.1.

Netherlands. Redeke, H. C. 1904.1, 1905.3.

Scandinavian coast. — *Norway.* Collett, R. 1874.1, 1875.3. — *Snaasen Lake, Flounder.* Nordgaard, O. 1906.1.

Sweden. Solea vulgaris as a freshwater fish. Hintze, A. 1887.1.

Danish waters. Krøyer, H. N. 1838.1.

MIGRATIONS AND MARKING EXPERIMENTS

The majority of articles on these subjects have been published in 1902 and the following years in the Reports listed below: Rept. Lancashire Sea-Fisheries Lab., Liverpool; Rept. Fishery Board for Scotland, London; Mitt. Deutsch. Seefischereivereins, and the publications of the Commission Wissenschaft. Untersuch. Deutsch. Meere, Kiel.

Although the migratory movements of the various genera and species differ slightly owing to external influences, such as temperature, we may in the main use the following summary of

Cole & Johnstone (1901.1, p. 218) as applicable to the Pleuronectidæ in general.

"Passive drift in-shore of developing eggs and metamorphosing larvæ terminating as the larva acquires the adult form and settles to the bottom. Slow outward movement of the young fish, deeper water being continually sought as it increases in size. This movement ends as the fish becomes mature. Thereafter its movements are probably very limited. During the spawning season it probably does not travel at all. With the extrusion of spawn another generation begins the migratory cycle."

The migratory habits of the flatfishes have been chiefly studied by means of marking experiments on plaice in the North and Irish and Baltic Seas. For a bibliography on plaice marking experiments, see Atkinson, G. T. 1912.1.

Marks in use in marking experiments. Heincke, F. & Bolau, H. 1906.1.

For investigations on the migration of Pleuronectidæ in order to determine questions of Size, Growth, Food, and Temperature effects, see the larger papers cited in this section and also these subjects in the Morphological Section.

General papers on the migrations of flatfishes. Cole, F. S. & Johnstone, J. 1901.1; ★Meek, A. 1916.1. — See also J. T. Jenkins "The Sea Fisheries." London, 1920, 299 p. figs., and various shorter papers on the results of the Northumberland investigations by Meek, (A. 1905.1, 1909.2, 1913.1, 1914.2, 3, 1915.3).

For detailed reports on localities, seasons, etc. of mature spawning migrations of Pleuronectidæ, see particularly the Reports of the Dove Marine Laboratory, Cullercoats.

Seasonal migration of Pleuronectidæ (in-shore in summer and into deeper water in winter, until maturity is reached). — Flounders marked in Elbe in autumn recaptured in Elbe. Ehrenbaum, E. 1907.3. — Young plaice appearing in the mouths of rivers. Feddersen, A. 1879.1; Hoek, P. 1888.1; Seeley, H. G. 1886.1. — "Where are plaice in winter?" Petersen, C. G. J. 1893.2. — Marked soles in the Zuyder Zee. Tendency to southwest migration. Redeke, H. C. 1905.1, 1911.1. — Flounders marked in Feb. and May on Bornholm grounds in Baltic, recaptured near coast the following summer. Strodtman, S. 1906.1.

Effects of seasonal migrations analyzed — for Forth school. Thompson, D. W. 1914.2; Fulton, T. W. ("Goldseeker" investigations) 1913.2. — for Northumberland school. Meek, A. 1916.1, p. 271.

Increase in growth of Plaice as result of transplantation to richer feeding grounds. Experiments in North Sea, 1896-1908. Borley, J. (Summary) 1912.2; Garstang, W. 1905.1; Petersen, C. 1896.4, 1897.1.

Migratory habits peculiar to certain flatfishes. — Plaice and Dab are usually found together. Plaice begins to spawn earlier in year than Dab. Cunningham, J. T. Add. 1898.1. — Flounder lives in estuaries and rivers, only descending to the

sea in the spawning season. Cunningham, J. T. Add. 1898.1.

Notes on migrations of Pleuronectidæ to various localities. (Chiefly seasonal feeding migrations.) — From Kattegat to Baltic. Mortensen, O. T. J. 1897.1. — In Trondhjemssjørd, Norway. Nordgaard, O. 1909.2. — To coastal grounds on west coast of Jutland. Johansen, A. C. Add. 1913.1, 2.

Marking experiments in various localities. — North sea. Atkinson, G. T. 1909.1-1912.1; Bolau, C. C. 1905.1; Ehrenbaum, E. 1907.3; Lee, R. M. & Atkinson, G. T. 1912.1; Reichard, A. C. 1909.1, 1910.1, 1915.1, 2. — Irish Sea. Farran, G. P. 1909.1; ★Johnstone, J. 1905.3, 5, 1911.1, 1912.2. — Baltic Sea. Johansen, A. C. 1905.1, 1909.1, 1910.1, 1912.1. — Iceland. Sæmundsson, B. 1913.1; Schmidt, E. J. 1907.1.

PHYLOGENY

Evolution and origin of species of flatfishes. Bateson, W. 1894.1; ★Cunningham, J. T. 1892.1, 1895.6, Add. 1898.1; Giard, A. 1892.1; Regan, C. T. 1910.6; ★Thilo, O. 1899.2, 1903.3.

TAXONOMY

Family Pleuronectidæ

See also general papers on this subject under Taxonomy in the Morphological Section.

Systematic works. Andrews, W. 1849.5; Boulenger, G. A. 1901.15; ★Cunningham, J. T. 1893.1, 1895.6, Add. 1894.1; ★Kyle, H. M. 1900.1.

For group and generic names given to larval forms, see Jordan, D. S. & Goss, D. K. 1889.1.

Geographical variations. Cligny, A. 1905.4. — India. Alcock, A. W. (Bay of Bengal) 1889.2; Jenkins, J. T. 1910.2. — East Indies. Bleeker, P. 1851.15, 1852.12, 1862.1, 9. — Africa. Boulenger, G. A. 1902.19. — Sicily. Facciola, L. 1885.2. — North America. Gill, T. N. 1865.14, 15, 1889.1; Lockington, W. N. (California) 1879.12. — Great Britain. Günther, A. C. 1890.1. — Review, America and Europe. Jordan, D. S. & Goss, D. K. 1889.1. — Review, Japan. Jordan, D. S. & Starks, E. C. 1906.3; Otaki, K. 1897.1. — North Sea. Keilhack, F. L. 1913.1. — Mediterranean Sea. Kyle, H. M. 1913.1. — Zealand, Netherlands. Steenstrup, J. J. S. 1835.1.

Variations and Relationships of various genera and species

Hippoglossoides, Pacific species. Schmidt, Peter. 1915.1.

Pleuronectes flesus. Duncker, G. 1900.2; Fabricius, O. 1824.1. — Sweden. Quensel, C. 1806.1. — Relationships between *P. flesus* and *P. platessa*. Duncker, G. 1895.1, 2, 1896.1; Hoek, P. P. 1890.2; Stead, F. B. 1897.4.

Pleuronectes platessa. Faber, F. 1840.1.

Variation of local forms. Cunningham,

J. T. 1895.5, (in size).10; ★Duncker, G. 1895.1, 2, 1896.1, 1913.1; Kyle, H. M. 1900.2; Petersen, C. G. 1894.1. — *Holland*. Gottsche, C. M. 1835.1. — *Baltic Sea*. Möbius, K. & Heincke, F. 1883.1. — *In Danish waters*. Stead, F. B. 1897.1. — *American "Plaice" a species of Parulichthys (P. dentatus)*. Goode, G. B. & others. 1887.1.

Pleuronichthys. Review. Starks, E. & Thompson, W. 1910.1.

Zeugopterus. Petersen, C. G. 1904.2.

Sub-family Soleinæ (Plagusinæ)

Synopsis. Kaup, J. J. 1858.4, 5.

Solea. *Great Britain*. Holt, E. W. L. & Byrne, L. W. 1905.1.

Fossil forms. — *Solea in Miocene of Switzerland*. Musy, M. 1913.1. — *Solea in Eocene of Egypt*. Woodward, A. S. 1910.2.

DIVISION KURTIFORMES

Family Kurtidæ

Kurtus. *Systematic position*. Beaufort, L. F. Add. 1914.1.

DIVISION GOBIIFORMES

Taxonomy. Heckel, J. J. 1836.1; Regan, C. T. 1911.14; Steindachner, F. 1861.1. — *Sunda-Molucca Archip.* Bleeker, P. 1849.1, 1851.13, 1874.1, 1875.2. — *North America*. Gill, T. N. 1864.9, 18. — *Review, Japan*. ★Jordan, D. S. & Snyder, J. O. 1901.9. — *Species in Mus. Nat. Hist. Paris*. Sauvage, H. E. 1880.2.

Evolution; possible line of descent. Starks, E. C. 1911.6.

Family Gobiidæ

Taxonomy. — *East Indies*. Beaufort, L. F. 1912.1. — *Gulf of Genoa*. Canestrini, G. 1861.2. — *Norway*. Collett, R. 1875.1. — *American species*. Eigenmann, C. H. & R. S. 1888.2; Jordan, D. S. & Eigenmann, C. H. (Review) 1887.1. — *Great Britain*. Holt, E. W. L. & Byrne, L. W. 1903.1. — *Dalmatia*. Kolombatović, J. 1891.1. — *Sweden*. Malm, A. W. 1874.2. — *Catalogue of Adriatic Sea forms*. Ninni, A. P. 1883.1. — *Taxonomy and natural history, Baltic sea*. Heincke, F. 1880.1.

Crystallogobius. — *Taxonomy and natural history, Norway*. Collett, R. 1877.2, 1878.3. — *Distribution, C. nilssonii*. Cunningham, J. T. 1891.1; Holt, E. W. Add. 1892.2.

Gobius. *Natural history*. Cambridge, F. P. 1903.1; Canestrini, G. 1865.1, 1867.1; Costa, O. G. 1844.2; Keene, J. H. 1879.5; Olivi, G. 1796.1; Holt, E. W. Add. 1897.4. — *Life-history and rate of growth*. ★Shann, E. W. 1910.1. — *Environment*. Smitt, F. A. 1896.1.

Taxonomy. — *Indian Archip. species*. Bleeker, P. 1878.1. — *Swedish species*. Fries, B. F. 1838.2. — *European forms*. Smitt, F. A. 1900.2; Fage, L. Add. 1914.1. — *Danish species*. ★Winther, G. P. 1874.3.

Latrunculus. — *Taxonomy. Review, East Indies*. Bleeker, P. 1876.8. — *Natural history and taxonomy*. Collett, R. 1873.1, 1877.2, 1878.3.

Lentipes. *Taxonomy; revision*. Grant, W. R. 1884.1.

Periophthalmus (Walking Fish). — *Taxonomy; synopsis*. Gill, T. N. 1864.17. — *Figure from life*. Hickson, S. J. Add. 1889.1.

For terrestrial locomotion, see under Locomotion.

For use of caudal fin as an accessory respiration organ, see under Caudal respiration under Respiration.

Philypnus. *Taxonomy; monograph*. Gill, T. N. 1861.6, 1862.1.

Sicydium and allies. *Taxonomy—East Indies*. Bleeker, P. 1876.8. — *Revision*. Grant, W. R. 1884.1.

Sub-family Eleotridinæ

Taxonomy—Review. Indian Archip. Bleeker, P. 1877.10. — *Review, America*. Eigenmann, C. H. & Fordice, M. W. 1886.2. — *Australia*. Ogilby, J. D. 1897.2, 1898.6. — *Review, New South Wales*. Waite, E. R. 1904.6.

DIVISION DISCOCEPHALI

Classification. Regan, C. T. 1912.2.

Family Echeneididæ

For the use of the sucking fishes as "living fish hooks," see under Remora-fishing in section on Fishing Methods.

For the sucking disk of Echeneids as a transformed spinous dorsal fin, see under Adhesive Disk.

For Echeneids as ship-holders, see under Mythology and Symbolism.

Taxonomy and relationships. Bleeker, P. (Sunda-Molucca Archip.) 1852.3; Costa, O. G. 1844.1; Duméril, A. H. 1858.1; Gill, T. N. 1865.6, 1882.5; Lütken, C. F. 1874.1 (v), 1877.3.

Echeneis. *Natural history*. ★Günther, A. C. 1860.6; Harting, P. 1867.1. — *Alleged capture in Michigan*. Smith, H. M. 1903.2. — *Fossil form*. Wettstein, A. 1886.1.

Remora. *Earliest figures and references*. — *General accounts*. Eastman, C. R. 1915.3, Add. 1916.3. — *In Pre-Linnæan Section*. Aristotle (First reference) 1476.1; Braccio, I. 1634.1; Chevalier, J. D. 1752.1; Imperato, F. (Earliest printed figure) 1593.1; La Roque, 1682.1; Massey, W. 1753.1; Vallisnieri, A. 1725.1.

DIVISION SCLEROPAREI

Taxonomy, Indian Archip. Bleeker, P. 1849.6, 1851.9, 16.

Family Scorpenidæ

Taxonomy. — *E. Indian Archipelago*. Bleeker, P. 1876.3, 4. — *Review, Japan*. ★Jordan, D. S. & Starks, E. C. 1904.4. — *Mediterranean*. Roule, L. 1907.1. — *Species in Paris Museum*. Sauvage, H. E. 1878.1.

Histiocephalus. *Taxonomy; Eocene.* Molin, R. 1860.1.

Scorpæna (Scorpionfish). *Natural history.* Holder, C. F. 1900.1; Holt, E. W. Add. 1893.6.

Taxonomy. — *Mediterranean species.* Jaquet, M. 1907.1. — *Review, American species.* Meek, S. E. & Newland, R. G. 1886.1.

Sebastes (Rosefish). *Natural history.* Fulton, T. W. 1901.1; Holt, E. W. Add. 1892.7.

Taxonomy and distribution. — *California species.* Ayres, W. O. 1860.3, 1863.1. — *American species.* Gill, T. N. 1864.14, 1865.1. — *Review, Japan.* Hilgendorf, F. M. 1880.4. — *Greenland.* Kroyer, H. N. 1845.10. — *Taxonomy and geographical distribution.* Sauvage, H. E. 1874.1.

Revision of Sebastes and allied forms. Eigenmann, C. H. & Beeson, C. H. 1894.3.

Sebastodes (Rockfish). *Taxonomy and relationships.* Eigenmann, C. H. & Beeson, C. H. 1893.1. — *Mediterranean species.* Jaquet, M. 1907.1.

Synancia and allied forms. *Taxonomy.* — *East Indies.* Bleeker, P. 1874.8. — *General account.* Gill, T. N. 1905.8.

Family Hexagrammidæ

Taxonomy, review, Japan. Jordan, D. S. & Starks, E. C. 1903.3.

Family Comephoridæ

Taxonomy, Lake Baikal. Berg, L. S. 1906.8, 1907.2; Korotnev, A. 1905.1.

Anoplopoma (Scombrocottus). *Natural history.* Swan, J. G. 1885.1.

Comephorus. *Natural history.* Dybowski, B. I. 1873.1, 1901.1; Grube, A. E. 1875.1; Günther, A. C. 1871.6; Korotnev, A. 1904.1; Tur, J. 1903.1; Zograf, N. Y. 1901.2, 1902.2.

Cottocomephorus. *Taxonomy and affinities.* Berg, L. S. 1906.8, 1907.2; Pellegrin, J. 1906.14.

Family Cottidæ (Sculpins)

For geographical distribution of fresh-water Cottidæ, see Meek, A. 1916.1 (p. 352).

Taxonomy. — *Lake Baikal.* Berg, L. S. 1903.1, 1906.8, 1907.2; Gracianov, V. I. 1901.1. — *Russia, fresh-water.* Gracianov, V. I. 1907.4. — *Fresh-water of North America.* Girard, C. F. 1852.2; Jordan, D. S. 1877.1. — *Review, Japan.* Jordan, D. S. & Starks, E. C. 1904.2. — *Greenland, Arctic forms.* Lütken, C. F. 1876.1 (i).

Cottus. *Natural history, distribution, etc.* Acloque, A. 1899.1; Bean, B. A. & Weed, A. C. 1910.2; ★Buschkiel, A. 1908.2; Lamarche, C. 1897.1; Lönnberg, A. J. 1900.7; Malmgren, A. J. 1870.1; Robinson, R. E. 1877.1. — *Distribution in Siberia.* Berg, L. S. 1906.5. — *Variation in Mälär Lake, Sweden.* Lönnberg, A. J. 1905.5.

Taxonomy, revision of genus. Girard, C. F. 1852.3; Jeitteles, L. H. 1861.1.

Fossil forms from — *Oligocene of Belgium.* Leriche, M. 1904.1. — *Tertiary of Aix.* Sauvage, H. E. 1873.7.

Myoxocephalus. *Natural history.* ★Gill, T. N. 1905.15.

Psychrolutes and allies. *Taxonomy, review.* Gill, T. N. Add. 1888.5.

Family Cyclopteriidæ

Taxonomy and relationships. Agassiz, J. L. 1858.7; ★Garman, S. 1892.1; Gill, T. N. 1891.6. — *Synopsis, eastern North America.* Gill, T. N. 1865.11. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1902.4.

Cyclogaster and related species. *Taxonomy, Japan.* Gilbert, C. H. & Burke, C. V. 1912.2.

Cyclopterus (Lumpfish). *Natural history.* Apstein, C. 1910.1; Bézier, T. 1894.1; Franz, V. 1907.3; ★Gill, T. N. 1907.3; Guitel, F. 1890.3; McIntosh, W. C. 1897.1; Putnam, F. W. 1874.3; Montagu, G. 1804.1, 1809.1; Smith, John A. 1867.3; Anon. 498; Grieve, S. Add. 1891.1; Gronovius, L. T. Pre-Linn. 1757.1.

For sucking disk, composed of the united ventral fins, see under Adhesive Disk.

Cyclopterichthys and **Liparops.** *Taxonomy.* Garman, S. 1892.1.

Family Liparididæ

Taxonomy. ★Garman, S. 1892.1. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1902.4.

Liparis (Sea Snail). *Natural history.* Kroyer, H. N. 1861.2; Lütken, C. F. 1861.1, 2, 1862.1; McIntosh, W. C. 1885.2; Nozeman, C. Pre-Linn. 1757.2.

Occurrence. — *on French coast.* Cligny, A. 1912.5. — *in Swedish waters.* Ekström, C. 1832.1; Schagerström, N. O. 1838.2. — *on Massachusetts coast.* Putnam, F. W. 1874.2, 3, 10. — *in Finnish waters.* Reuter, O. M. 1892.1; Suomalainen, F. W. 1911.1. — *in Ireland.* Scharff, R. F. 1890.1. — *in Firth of Forth.* Evans, W. Add. 1897.1.

Family Platycephalidæ

Taxonomy. — *Revision, Indian Archip.* Bleeker, P. 1879.5. — *Japan.* Jordan, D. S. & Richardson, R. E. 1908.2. — *Species in Paris Museum.* Sauvage, H. E. 1878.1.

Family Hoplichthyidæ

Taxonomy, Japan. Jordan, D. S. & Richardson, R. E. 1908.2.

Family Agonidæ

Taxonomy, review, Japan. Jordan, D. S. & Starks, E. C. 1904.3.

Family Triglidæ

Taxonomy. Gill, T. N. 1888.4, 1889.5; Kaup, J. J. 1858.1, 1873.1; Sauvage, H. E. 1873.1. — *Synopsis, Maltese forms.* Gulia, Gavino. 1858.1. — *Japan.* Jordan, D. S. & Richardson, R. E. 1908.2. —

Mediterranean. Roule, L. 1907.1. — *Species in Paris Museum*. Sauvage, H. E. 1878.1.

Prionotus (*Sea Robin*). *Taxonomy, review*. Jordan, D. S. & Hughes, E. G. 1887.1.

Trigla (*Mailed Gurnard*). *Natural history*. Bianconi, G. G. 1856.1; Embleton, R. 1834.1; Emery, C. 1879.1 (x); Holder, C. F. 1909.1; Shufeldt, R. W. 1898.5; Holt, E. W. Add. 1898.5.

Family Dactylopteridæ

Taxonomy, synopsis. Gill, T. N. 1891.1.

Cephalacanthus (*larval form*). *Taxonomy, Japanese species and related forms*. Jordan, D. S. & Richardson, R. E. 1908.2.

Dactylopterus (*Flying Gurnard*). *Natural history (development)*. Canestrini, G. 1861.3.

DIVISION JUGULARES

Taxonomy. Duméril, A. M. 1855.1.

Family Trachinidæ

Taxonomy. Boulenger, G. A. 1901.15.

Natural history. ★Gill, T. N. 1907.2.

Trachinus (*Weever*). *Natural history, popular accounts, descriptions, etc.* Emery, C. 1879.1 (xii); McIntosh, W. C. 1886.6; Meier, H. 1865.1; Winkler, T. C. 1857.5; Holt, E. W. Add. 1898.4.

Taxonomy. Review. Bleeker, P. 1861.7.

For poison glands and effects of poisons, see under Poisonous fishes.

Family Leptoscopidæ

Taxonomy. — Synopsis of genera. Gill, T. N. 1863.16. — *Review, Japan*. Jordan, D. S. & Snyder, J. O. 1902.7.

Chimarrichthys. *Taxonomy, synopsis*. Regan, C. T. 1905.17.

Family Nototheniidæ

Taxonomy. — Synopsis. Gill, T. N. 1862.25; Regan, C. T. 1914.1. — *Review, Japan*. Jordan, D. S. & Snyder, J. O. 1902.7. — *Tierra del Fuego*. ★Smitt, F. A. 1897.1.

Chænichthys. *Taxonomy, synopsis*. Gill, T. N. 1862.22.

Harpagifer. *Taxonomy, synopsis*. Gill, T. N. 1862.24.

Family Uranoscopidæ

Natural history. ★Gill, T. N. 1907.2.

Taxonomy. — Synopsis. Gill, T. N. 1862.9, 30. — *Review, Japan*. Jordan, D. S. & Snyder, J. O. 1902.7. — *Review of the European and American species*. Kirsch, P. H. Add. 1889.1.

Uranoscopus (*Star-gazer*). *Taxonomy. Review, Indian Archip.* Bleeker, P. 1878.4.

Family Callionymidæ

Taxonomy. — Review, Indian Archip. species. Bleeker, P. 1879.4. — *List of American species*. Eigenmann, C. H. & R. S. 1888.2. — *Review, Japan*. Jordan,

D. S. & Fowler, H. W. 1902.4. — *Gulf of Genoa*. Canestrini, G. 1862.1.

Callionymus (*Dragonet*). *Taxonomy*. Fries, B. F. (*Synopsis*) 1839.1; Gill, T. N. 1860.10; Schagerström, N. O. (*Swedish species*) 1830.1.

Natural history notes, descriptions, etc. Doderlein, P. & Riggio, G. 1890.1; Ninni, A. P. 1877.1; Brook, G. Add. 1885.1; Holt, E. W. Add. 1898.1; Gronovius, J. Pre-Linn. 1740.1; Tyson, E. Pre-Linn. 1706.1.

Family Gobiesocidæ

Taxonomy. Brisout de Barneville, C. N. 1846.1. — *Review, Japan*. Jordan, D. S. & Fowler, H. W. 1902.3.

Lepadogaster (*Clingfish*). *Natural history accounts*. Brook, G. 1890.1; Byrne, L. W. 1902.2; Drew, J. 1872.1; Guitel, F. 1890.6.

Taxonomy. — On French coast. Jourdain, S. 1879.2. — *Synopsis*. Brisout de Barneville, C. N. 1846.3. — *Mediterranean Sea*. Canestrini, G. 1864.3. — *Differentiation of L. bimaculatus and L. microcephalus*. Guitel, F. 1904.1, 2.

For ventral sucking disk, composed of the united pelvic fins, see under Adhesive Disk.

Family Blenniidæ

Taxonomy. — East Indies. Bleeker, P. 1849.1, 1851.13. — *Gulf of Genoa*. Canestrini, G. 1862.1; Vinciguerra, D. 1879.1. — *Messina, Sicily*. Facciola, L. 1885.1. — *Review, South African species*. Gilchrist, J. D. & Thompson, W. W. 1908.1, 1911.1. — *Review, Japan*. Jordan, D. S. & Snyder, J. O. 1902.3.

Blennius (*Blenny*). *Natural history notes*. Bonaparte, C. L. 1840.5; Forbes, E. 1836.1; Gervais, F. L. 1859.1; Lunel, G. 1870.1; Montagu, G. 1809.1; Mourgue, M. 1909.1; Steenstrup, J. 1865.2; Anon. 99; Walbaum, J. J. Add. 1775.1; Gissler, N. Pre-Linn. 1748.1.

Labrosomus. *Taxonomy, review*. Gill, T. N. 1861.5.

Lumpenus. *Natural history, occurrence, etc.* Brenner, M. M. 1874.1; Day, F. 1884.7, 1885.9; Fulton, T. W. 1901.1; Gottberg, G. 1910.3; Häyrén, E. 1900.1; Krøyer, H. N. 1837.2, 4, 5; ★Sim, G. 1887.1; Holt, E. W. Add. 1893.3.

Nemophis and allies. *Taxonomy and relationships*. Putnam, F. W. 1874.8.

Stichæus. *Taxonomy, synopsis*. Gill, T. N. 1865.5.

Family Batrachidæ

Natural history. ★Gill, T. N. 1907.2.

Taxonomy. — Review, American species. Meek, S. E. & Hall, E. A. 1886.1. — *Revision, Queensland*. Ogilby, J. D. 1908.4.

Opsanus (*Batrachus*) (*Toadfish*). *Batrachus gigas in Seychelles*. Ward, Swinburne. 1869.1.

For a study of the habits and life history of the Toadfish, with many illustrations and

with a review of the literature, see Gudger, E. W. 1910.1.

Thalassophryne and Thallassothis. Revision. Bean, B. A. & Weed, A. C. 1910.3.

Family Pholididae

Nomenclature. Gill, T. N. 1896.17.

Pholis (Gunnel or Butterfish). — Natural history notes. Gottberg, G. 1910.5; Walbaum, J. J. Add. 1783.2. — Nomenclature. Gill, T. N. 1896.4.

Family Zoarcidae

For a map showing the geographical distribution of the Zoarcidae and related families, see Meek, A. 1916.1 (p. 380).

Taxonomy. — Synopsis. Gill, T. N. 1864.20. — Review, Japan. Jordan, D. S. & Fowler, H. W. 1902.5. — Arctic Ocean. ★Knipovich, N. M. 1906.3. — Argentina. Lahille, F. 1908.3.

Sub-family Anarrhichadinæ

Taxonomy. — Gulf of Genoa. Canestrini, G. 1862.1. — Review, Japan. Jordan, D. S. & Snyder, J. O. 1902.3.

Anarrhichas (Wolf-fish). — Natural history notes, descriptions and occurrence. Baird, S. F. 1876.4; Broussonet, P. M. 1785.2; Crisp, E. 1853.1; De Vis, C. W. 1865.1; Fulton, T. W. 1905.2; Gill, E. L. 1904.1, 1906.1; Jones, J. M. 1865.1; Young, M. & Eagle Clarke, W. 1892.1. — Taxonomy and synonymy. Steenstrup, J. J. 1876.2–1877.2.

Sub-family Brotulinæ

For a map showing the distribution of the Brotulinæ, see Meek, A. 1916.1 (p. 380).

Taxonomy. — Western North America. Gill, T. N. 1864.8. — Review, Japan. Jordan, D. S. & Starks, E. C. 1902.5. — Philippines and Dutch East Indies. Radcliffe, L. 1913.2. — Abyssal species of northern Atlantic. Roule, L. 1915.5.

Sub-family Lycodinæ

Taxonomy. — Synopsis. Gill, T. N. 1864.20. — Northern Europe and Greenland. ★Jensen, A. S. 1904.2.

Lycodes. — Natural history and taxonomy. Collett, R. 1899.1; Smitt, F. A. 1900.1. — Taxonomy and distribution in Arctic ocean. ★Knipovich, N. M. 1906.3; Lütken, C. F. 1876.1 (iii). — Variations. Jensen, A. S. 1901.1.

Family Ophidiidae

Taxonomy. — Review, Japan. Jordan, D. S. & Fowler, H. W. 1902.5. — Revision. Putnam, F. W. 1874.4. — General account. Kaup, J. J. 1856.3.

Genypterus. Natural history. Delfin, F. T. 1903.3.

Family Podatellidae (Ateleopodidae)

Taxonomy, Philippines. Radcliffe, L. 1913.1.

Group Blennoidea

Classification. Regan, C. T. 1912.5.

DIVISION TÆNIOSOMI

Taxonomy and relationships. Gill, T. N. 1890.1, Add. 1887.1; Regan, C. T. 1907.11.

Family Trachypteridae

Caudal rays of *Regalecus* and *Trachypterus*. Smitt, F. A. Add. 1888.1.

Regalecus (Gymnetrus) (Oarfish, or "King of the Herrings"). Natural history notes, miscellaneous accounts and descriptions. Ascanius, P. 1788.1; Brünnich, M. T. 1788.1; Couch, J. 1863.1; Drew, S. H. 1898.1; Jones, J. M. 1860.1, 2, 3; Jourdain, S. 1872.1; L'Eost, — 1904.1; Lindroth, P. G. 1798.1; McIntosh, W. C. 1902.3; Risso, A. 1840.1.

Regalecus as the sea serpent. Collett, R. 1884.1; Highley, S. 1877.1; Holder, C. F. 1903.2; Holder, C. F. & Jordan, D. S. 1913.1; Anon. 496.

Occurrence — in Mediterranean. Barceló y Combis, F. (Mallorca) 1877.1; Buckland, F. T. (Nice) 1877.1; Damiani, G. (Elba I.) 1913.1; Nardo, G. D. (Adriatic Sea) 1824.1. — Norway. Collett, R. 1883.2; Grieg, J. A. 1886.1, 1900.1. — Scotland. Evans, W. 1908.1; F., A. 1880.1; McIntosh, W. C. 1896.1; Walker, R. 1862.1. — coast of England. Hancock, A. & Embleton, D. 1846.1; Harting, J. E. 1880.1; Hogg, J. 1866.1, 2; Jacob, J. 1849.1; Southwell, T. 1880.1, 2, 3; Tristram, H. B. 1866.1; W., J. 1877.2; Whitfield, E. 1849.1. — in Table Bay, S. Africa. Layard, E. L. 1868.1, Add. 1869.1.

Distribution in western Atlantic. — At New Harbor, Maine. Hanna, S. W. 1883.1. — In Bermudas. Jones, J. M. 1860.2, 3; Newman, E. 1860.2; Nilsson, S. 1860.3, 5. — Off Charleston, S. C. Rea, P. M. 1909.1.

Distribution in Pacific. — On California coast. Jordan, D. S. 1902.8. — Australia. De Vis, C. W. (Queensland) 1892.1; Ramsay, E. P. (Port Jackson) 1881.5; Waite, E. R. (New South Wales) 1899.3; Alexander, W. B. Add. 1914.1. — New Zealand. Benham, W. B. 1903.1; Clarke, F. E. 1898.1; Forbes, H. O. 1892.1; Haast, J. F. 1878.1; Kingsley, R. I. 1889.1; Parker, T. J. 1884.2, 1887.2, Add. 1883.1.

Taxonomy. — Mediterranean species. Damiani, G. 1913.1. — British species. Gray, J. E. 1850.2. — *G. banksii*. ★Lütken, C. F. 1876.1 (iv), 1877.2, 1882.1.

Trachypterus (Dealfish or Northern Ribbonfish). Natural history, general accounts, descriptions, etc. Bonaparte, L. C. 1842.6; Costa, A. 1862.2; Duguid, — 1851.1; Fleming, J. 1831.1; Kner, R. 1859.1; ★Reinhardt, J. C. 1838.2. — Earliest description. Goüan, A. 1770.1.

Occurrence — at Amboina. Bleeker, P. 1868.8. — in England. Bolam, G. 1891.1; Cole, F. J. 1913.1; Anon. 152. — on coast of Scotland. Cursiter, J. W. 1896.1; Edwards, T. 1879.1; Evans, W. 1909.1; Lemmon, J. 1905.1; Reid, J. (Firth of Forth) 1849.1; Traquair, R. H. (Shetland)

1896.1. — *at Venice*. Grisellini, F. 1766.1, 1768.1, 2. — *in California*. Jordan, D. S. & Gilbert, C. H. 1894.1; Snyder, J. O. 1908.3. — *at Madeira Is.* Lowe, R. T. 1852.1. — *in Gulf of Marseilles*. Vaysière, A. 1908.1, 2. — *in Ireland*. Anon. 583; Newman, E. Add. 1875.3.

Taxonomy and relationships. — *Mediterranean Sea*. Bonelli, F. A. 1819.1. — *New Zealand forms*. Clarke, F. E. 1881.1. — *Arctic forms*. ★Lütken, C. F. 1876.1 (iv), 1877.2, 1882.1. — *Species in New South Wales*. Ogilby, J. D. 1898.5. — *Chilian forms*. Philippi, R. A. 1874.1. — *Bergen Museum specimens*. Stuwitz, P. 1840.1.

Family Lophotidae

Lophotes. *Occurrence* — *at Cape of Good Hope*. Boulenger, G. A. 1900.13, 1902.26; Günther, A. C. 1890.2; Trimen, R. 1891.1. — *on New Zealand coast*. Clarke, F. E. 1897.1; Parker, T. J. 1894.1. — *in Gulf of Genoa*. Cuvier, G. L. 1813.1. — *Tasmania*. Johnston, R. M. Add. 1883.1.

SUB-ORDER ATELAXIA

Characters of this new sub-order. Starks, E. C. 1908.1.

Family Stylephoridae

Stylephorus (Stylophorus). *Notes, descriptions, etc.* Blainville, H. M. 1818.1; Mitchill, S. L. 1832.1. — *Original description*. Shaw, G. 1791.1.

Taxonomy and relationships based on osteological characters. Regan, C. T. 1908.24; Starks, E. C. 1908.1.

SUB-ORDER OPISTHOMI

Family Mastacembelidae

For a map showing the geographical distribution of the Mastacembelidae, see Meek, A. 1916.1 (p. 314).

Taxonomy; revision, African species. Boulenger, G. A. Add. 1909.1.

Mastacembelus. *Taxonomy*. — *Indo-Australian Archip.* Bleeker, P. 1866.9. — *Synopsis*. Boulenger, G. A. 1912.10.

SUB-ORDER PEDICULATI

Natural history. ★Gill, T. N. 1909.1. *Taxonomy*. Annandale, N. & Jenkins, J. T. (India) 1910.1; Gill, T. N. 1864.7, 1880.2, 1883.12; Jordan, D. S. & Sindo, M. (Japan) 1902.2; Supino, F. 1908.3.

Family Lophiidae

Taxonomy, revision. Regan, C. T. 1903.11.

Lophius (Angler, or Fishing-frog). *Natural history, occurrence, etc.* ★Fulton, T. W. 1903.1; Geare, R. I. 1903.1; ★Gill, T. N. 1905.4; Honeyman, D. 1886.2; Jones, A. H. 1878.1; Kent, W. S. 1874.1; Montin, L. 1779.1; Turner, W. 1902.1; Anon. 377; Hanow, M. C. Add. 1768.1; Parsons, J. Pre-Linn. 1750.1.

Angling apparatus of Lophius. — *Fishing lure, development, morphology, and*

function. Bailly, E. M. 1824.1; Fritsch, G. T. 1884.2; Geoffroy-Saint-Hilaire, E. F. 1824.7, 8, 11, 1827.1; Jourdain, S. 1861.2; Ryder, J. A. 1885.3; Wyman, J. 1848.1. — *Branchial sacs as an angling apparatus*. Geoffroy-Saint-Hilaire, E. F. 1807.6, 1827.1.

Family Ceratiidae

Taxonomy, synopsis. Gill, T. N. 1879.2.

Ceratias. *Natural history, description and taxonomy*. Kroyer, H. N. 1845.7. — *Arctic regions*. ★Lütken, C. F. 1880.1, 4.

Himantolophus. *Natural history, descriptions and occurrence*. ★Lütken, C. F. 1880.1, 4, 1887.2, 1894.1, Add. 1886.1; Girard, A. A. 1893.2; Williamson, H. C. 1911.2.

Melanocetus. *Descriptions*. Günther, A. C. 1864.8; Regan, C. T. 1913.4.

Oneirodes. *Description*. Lütken, C. F. 1871.2.

Family Antennariidae

For alleged Nest-building, see Parental care under Reproduction.

Taxonomy, synopsis. Gill, T. N. 1879.1.

Antennarius (Chironectes). *Natural history, structure and relationships*. Cuvier, G. L. 1817.2; Dönitz, F. K. W. 1867.1; Steenstrup, J. J. 1864.1. — *Variability*. Pietschmann, V. 1909.2.

Pterophryne (Mousefish or Sargassum-fish). — *Natural history, nomenclature, etc.* Braam Houckgeest, A. 1774.1; Hjortberg, G. F. 1768.1, Add. 1771.1; Martini, F. H. Add. 1773.1, 3; Seba, A. Pre-Linn. 1734.1. — *Nomenclature*. Gill, T. N. 1879.5. — *Alleged capture in Onondaga lake, New York*. Smith, H. M. 1903.2.

Family Malthidae

Taxonomy, synopsis. Gill, T. N. 1879.3.

Malthe (Batfish). *Natural history notes*. Hutchinson, J. 1797.1; Lütken, C. F. 1865.1; Nicolson, — Add. 1776.1; Seba, A. Pre-Linn. 1734.1.

SUB-ORDER PLECTOGNATHI

Taxonomy. Dareste, C. 1850.2; ★Hollard, H. L. 1860.1; Nardo, G. D. 1842.1, 1843.2; Regan, C. T. 1902.1. — *Indian forms*. Annandale, N. & Jenkins, J. T. 1910.1. — *Specimens in Museum, University of Rome*. Carruccio, A. 1912.1. — *Synopsis*. Gill, T. N. 1885.6.

DIVISION SCLERODERMI

Taxonomy. — *Fossil forms*. Gill, T. N. 1888.3, 5. — *Review, Japan*. ★Jordan, D. S. & Fowler, H. W. 1902.7. — *General account*. Kaup, J. J. 1855.3.

Family Triacanthidae

Triacanthus. *Taxonomy, revision*. Regan, C. T. 1903.12.

Family Balistidae

(Filefishes or Triggerfishes)

General treatise (bony structure, classification, etc.). ★Hollard, H. L. 1853.1.

Taxonomy and relationships. — *Indo-Australian Archip.* Bleeker, P. 1852.1, 1866.13, .14. — *Affinities.* Dareste, C. 1872.2, .3. — *Eocene of Monte Bolca.* Zigno, A. 1887.1.

Balistes (*Leather-Jacket*). *Natural history, descriptions, occurrence, etc.* Carte, A. 1854.1; ★Möbius, K. A. 1889.1; Nardo, G. D. 1827.3; Sonnerat, P. 1774.1; Garman, S. Add. 1891.2. — *On English coast.* Gray, J. E. 1873.1; Toms, H. S. 1901.1. — *In Scandinavia.* Malm, A. W. 1875.1. — *At Cork Co., Ireland.* Scharff, R. F. 1910.2. — *Dutch East Indies.* Schlosser, J. A. 1869.1. — *In Massachusetts waters.* Storer, D. H. 1848.14.

Taxonomy; Dutch East Indies. Bleeker, P. 1862.1.

Palæobalistes. *Structure and taxonomy.* Kner, R. 1867.2.

Family Ostraciontidae (Trunkfishes)

General treatise (bony structure, classification, etc.). ★Hollard, H. L. 1857.2. — *Comment on Hollard.* Duméril, A. M. 1857.1.

Taxonomy. — *Dutch East Indies.* Bleeker, P. 1852.1, 1862.1, 1866.13, .14. — *American species.* Goode, G. B. 1879.15.

Aracana. *Taxonomy, revision.* Waite, E. W. & McCulloch, A. R. 1915.2.

Ostracion (*Trunkfish*). *Natural history and occurrence.* Couch, J. (*English coast*) 1864.1; La Blanchère, P. R. 1874.2.

DIVISION GYMNODONTES

General treatise (bony structure as a basis for classification). ★Hollard, H. L. 1857.1.

Taxonomy. Bleeker, P. 1862.1, 1866.13, .14. — *Review, Japan.* Jordan, D. S. & Snyder, J. O. 1901.10.

Family Tetrodontidae Puffers or Globefishes

Taxonomy. Duméril, A. H. 1854.1; Gill, T. N. 1892.1. — *Review, American species.* Jordan, D. S. & Edwards, C. L. 1887.1. — *Revision, African species.* Boulenger, G. A. Add. 1909.1. — *Italian fossil forms.* Portis, A. Add. 1889.1.

Evolution; progenitors. Thilo, O. 1914.1.

Tetrodon (**Tetraodon**). *Natural history.* Bugnion, E. 1911.1; Domsma, M. Add. 1770.1; Walbaum, J. J. Add. 1779.1.

For nature of its poisonous flesh, see under Poisonous fishes.

Family Diodontidae

Taxonomy. Brisout de Barneville, C. 1846.2; Cuvier, G. L. 1818.1; Duméril, A. H. 1854.1. — *Review, American species.* Eigenmann, C. H. 1885.1.

Diodon (*Porcupinefish*). *Fossil forms* — *in Miocene.* Cope, E. D. (*North Carolina*) 1872.8; Pantanelli, D. (*Italy*) 1897.1; Pasquale, M. (*Sardinia*) 1905.1.

— *in Eocene.* Lydekker, R. (*Burma*) Add. 1880.1; Portis, A. (*Italy*) Add. 1889.1.

Family Molidæ Ocean Sunfishes

General treatise; natural history, distribution, structure and taxonomy (with a full bibliography). ★Steenstrup, J. J. & Lütken, C. F. 1898.1.

Taxonomy. Nardo, G. D. 1839.1; ★Ranzani, C. 1839.1; Gill, T. N. Add. 1897.1.

Orthogoriscus (**Mola**). *Natural history notes, popular accounts, and descriptions.* Agassiz, J. L. 1856.5; Acloque, A. 1897.3; Albert I, H. C. 1889.1; Bonaparte, C. L. 1840.3; Embleton, D. 1854.1; Gachet, H. 1832.1; Grieg, J. A. 1903.1; Holder, C. F. 1904.2; Jacob, A. 1826.1; Lidth de Jeude, T. 1892.1; Lindes, L. 1880.13; Lönnberg, A. J. 1909.1; McIntosh, W. C. 1908.2; Maitland, R. T. 1859.1; Marsillon, C. 1897.1; Porter, C. E. 1904.3; Retzius, A. J. 1785.1; Stossich, M. 1880.1; Gadeau de Kerville, H. Add. 1894.1.

Distribution. — *English coast.* Bell, A. S. 1870.1, .2; Clarke, W. J. 1896.1, 1898.1; Cornish, T. 1866.5, 1879.3; Couch, J. 1841.1; Crooks, St. J. 1860.1; Gatcombe, J. 1878.2; Gurney, J. H. 1875.2; Parlby, — 1849.1. — *In Irish waters.* Andrews, W. 1871.1; Bellingham, O. 1840.1. — *Off Scottish coast.* Campbell, J. M. 1881.1; Clark-Kennedy, A. 1875.2; Saxby, H. L. (*Shetland*) 1866.1; Anon. 330.

Occurrence in various localities. — *In East Indies.* Bleeker, P. 1873.10. — *In Italy.* Carruccio, A. 1912.1. — *In Halifax harbor.* Gilpin, J. B. 1874.1. — *Off Portugal.* Girard, A. A. 1894.1. — *At New Zealand.* Hamilton, A. 1886.1. — *Off Mauritius.* Liénard, E. 1840.1. — *In Scandinavia.* Lütken, C. F. 1864.1; Steenstrup, J. J. & Lütken, C. F. 1862.1. — *In Atlantic.* Morthimer, J. H. 1866.1. — *Adriatic Sea.* Nardo, G. D. 1827.2. — *On Dutch coast.* Reuvsen, C. L. 1897.2. — *At Boston, Mass.* Storer, D. H. 1844.10. — *New Zealand.* Williams, W. L. 1893.1. — *At Brest, France.* Anon. 155. — *In Rio Povedra, Spain.* Colomina, A. Add. 1910.1. — *On California coast.* Hilton, W. A. Add. 1914.1. — *In Nova Scotia.* Piers, H. Add. 1898.1.

Malacanthus (*Larval form of Orthogoriscus*). Guichenot, A. 1848.3.

Ranzania. *Natural history, occurrence, descriptions, etc.* Katuric, M. 1891.1; Stossich, M. 1880.1. — *Hawaiian islands.* Jenkins, O. P. 1895.1. — *Catania, Sicily.* Mauro, S. D. 1905.1. — *Ceylon.* Pearson, J. 1911.2. — *California coast.* Snyder, J. O. 1913.1. — *Martinique.* Pellegrin, J. 1912.14. — *Irish coast.* Scharff, R. F. 1906.2.

SEDIS INCERTÆ

Fossil "fishes" whose affinities with recent fishes are either unknown or are so uncertain that they are set apart here.

General treatise. Woodward, A. S. 1889.2.

I PALÆOSPONDYLIDÆ

Palæospondylus gunni. *Structure and relationships.* — *General accounts.* ★Dean, B. 1896.2, 1896.6, 1898.3, 1900.1, 1904.12; ★Sollas, W. J. & I. B. 1904.1; Traquair, R. H. 1890.7, 1893.1, 1894.7, 8, 1897.2, 4. — *Shorter papers.* Eastman, C. R. 1900.7; Gill, T. N. 1896.8; Kemna, A. 1904.2; Kerr, J. G. 1900.3; Osborn, H. F. 1900.1.

II OSTRACODERMI**Silurian and Devonian Fishes**

Structure and affinities. ★Agassiz, J. L. 1842.2, 1843.1, 1844.3, 1846.3; Asmuss, H. 1839.1, 1856.1; ★Claypole, E. W. 1884.3, 4, 5, 1891.1; Cope, E. D. 1877.4, 1881.2; ★Kemna, A. 1903.2; Miller, H. 1841.1, 1848.1, 2, 1849.1, 1857.1; ★Pander, C. H. 1856.1, 1857.1; Patten, W. 1902.1, 1903.3; Schlüter, C. A. J. 1888.1; ★Traquair, R. H. 1899.3; Woodward, A. S. 1889.2. — *Depressiform adaptations.* Dollo, L. 1909.4. — *Popular account.* Dawson, J. W. Add. 1893.1.

ORDER HETEROSTRACI

Morphology and affinities. Kemna, A. 1903.2.

Family Cœlepidæ

Structure, affinities and taxonomy. ★Kemna, A. 1904.2; Pander, C. H. 1856.1; Traquair, R. H. 1899.3, 1905.2.

Thelodus. *Morphology and classification.* Röse, C. 1897.1; Traquair, R. H. 1899.2.

Family Drepanaspidæ

Drepanaspis gemündenensis. *Structure and relationships.* Kemna, A. 1904.2; ★Traquair, R. H. 1899.3, 1900.4, 1902.1, 1903.2, 1905.3. — *Scales, marginal and ridge.* Eastman, C. R. 1904.7.

Family Psammosteidæ

Morphology and systematic position. Preobrajensky, J. A. 1911.1; ★Rohon, J. V. (*Anatomy*) 1901.1; Traquair, R. H. 1896.4, 1899.3; Woodward, A. S. 1911.3.

Family Pteraspidæ

Morphology, taxonomy and relationships. Alth, A. 1884.1, 1886.1, 2; Claypole, E. W. 1885.1; Jaekel, O. 1894.2; Kemna, A. 1904.2; Lankester, E. R. 1897.1; Patten, W. 1903.2; ★Rohon, J. V. 1893.1, 1896.1; Schmidt, Fried. 1873.3; Traquair, R. H. 1899.3.

Cyathaspis (Diplaspis). Alth, A. 1886.2; Geinitz, H. B. 1884.1; Lankester, E. R. 1873.2; Lindström, G. 1894.1, 1896.1; Matthew, G. F. 1886.1–1891.1; Roemer, C. F. 1856.1.

Holaspis. *Taxonomy.* Lankester, E. R. 1873.2.

Palæaspis. *Structure and occurrence (in Silurian of Pennsylvania).* Claypole, E. W. 1885.1, 1892.4; Jaekel, O. 1894.2.

Scaphaspis. *Structure (shield and scales) and taxonomy.* Alth, A. 1884.1, 1886.1, 2; Lankester, E. R. 1870.3, 1873.1, 2, 1874.1, 1884.1.

Pteraspis. — *Morphology (cephalic shield and scales) and classification.* Alth, A. 1884.1, 1886.1, 2; Dollo, L. 1903.2; Dorlodot, H. 1912.1, 2; Drevermann, F. 1904.1; Fraipont, C. 1908.1, 1912.1; Gosselet, J. A. 1903.1; ★Huxley, T. H. 1858.1, 2, 1861.2, 1862.1, Add. 1858.1; Katzer, F. (*Brazil*) 1897.1; Kunth, A. 1872.1; ★Lankester, E. R. 1856.1, 1861.1, 2, 1864.2–1866.2, 1873.1, 2, 1874.1; ★Leriche, M. 1903.1, 2, 1912.3, Add. 1912.1; Powrie, J. 1863.1, 1864.2; Schmidt, Fried. 1873.1, 2, 3; Salter, J. W. 1859.1, 1867.2; Woodward, A. S. 1899.6; Huxley, T. H. & Salter, J. W. Add. 1856.1. — *Restoration.* Lankester, E. R. 1862.1; Mitchell, H. 1862.1. — *Distribution in England.* Roberts, G. E. 1861.1.

ORDER OSTEOSTRACI

Structure and affinities. Kemna, A. 1903.2; Kiær, J. 1911.1.

Family Ateleaspidæ

Ateleaspis. *Structure and taxonomy.* Traquair, R. H. 1899.3, 1905.2.

Family Cephalaspidæ

General treatise. ★Powrie, J. & Lankester, E. R. 1868.1.

Morphology and taxonomy. Kner, R. 1847.1; Lankester, E. R. 1870.2, 4, 1897.1; ★Pander, C. H. 1856.1; Patten, W. 1903.2; Powrie, J. 1861.3, 1870.1; ★Rohon, J. V. 1893.1, 1896.1.

Cephalaspis. *Structure (scales, etc.) and classification.* Eastman, C. R. 1904.7; Huxley, T. H. 1858.2; Niedzwiedzki, J. 1903.1; Salter, J. W. 1869.1; Schmidt, Fried. 1866.1, 1894.1; Traquair, R. H. 1893.6, 1894.5, 1899.1; Woodward, A. S. 1901.2.

Distribution in England. Lightbody, R. 1861.1; Roberts, G. E. 1861.1.

Didymaspis. *Taxonomy.* Lankester, E. R. 1867.2, 3.

Thyestis (Auchenaspis). — *Silurian of Victoria.* Chapman, F. R. 1906.1. — *Morphology and taxonomy.* Rohon, J. V. 1892.2, 1896.1, 2. — *Skull; metamerism.* Rohon, J. V. 1894.1, 1895.2. — *In Silurian of Ösel I.* Schmidt, Fried. 1866.1; Eichwald, C. E. Add. 1854.1.

Family Tremataspidæ

Morphology and affinities. Eastman, C. R. 1902.5, 1904.4; ★Patten, W. 1901.1; ★Rohon, J. V. 1892.2, 1893.2, 1894.2, 1896.1.

Tremataspis. — *Appendages, views concerning.* Eastman, C. R. 1903.2; Jaekel, O. 1903.2; ★Patten, W. 1903.1. — *Skull; metamerism.* Rohon, J. V. 1894.1.

ORDER ANASPIDA

Comprising the family Birkeniidæ and the genera *Birkenia* and *Lasanius*, and doubtfully *Euphanerops*.

Morphology and taxonomy. Kemna, A. 1903.2; Kiær, J. 1911.1; ★Traquair, R. H. 1899.3, 1905.2. — *Euphanerops*. Woodward, A. S. 1900.6.

III ANTIARCHI

Fishes of the Old Red Sandstone

Group established. Traquair, R. H. 1894.2.

Family Asterolepidæ

Monograph. ★Traquair, R. H. 1894.2, 1904.1, 1906.1.

Anatomy and systematic position. ★Jaekel, O. 1903.4; Lankester, E. R. 1897.1; Pander, C. H. 1887.1; ★Traquair, R. H. 1888.5, 1893.5.

Pectoral appendages, structure. Eastman, C. R. 1904.1; ★Hoffman, G. 1911.1; Jaekel, O. 1893.2.

Asterolepis. — *General popular treatise.* ★Miller, H. 1849.1.

Structure and affinities. Hoffman, G. 1909.1; ★Kemna, A. 1904.2; Miller, H. 1848.2; Eichwald, C. E. Add. 1840.1. — *Hyoid-plate; structure.* Miller, J. 1869.1.

Holonema. — *Structure.* Claypole, E. W. 1883.1, 1890.2. — *Pectoral limb.* Cope, E. D. 1891.3, 1892.5. — *Ventral plates of carapace.* Williams, H. S. 1891.1, 1893.1.

Bothriolepis. *Structure and affinities.* Eastman, C. R. 1904.9; Lahusen, I. I. 1880.1; ★Patten, W. 1904.1, 1905.1; Roberts, G. E. 1864.1; Trautschold, H. 1881.1; Whiteaves, J. F. 1887.1.

Pterichthys. — *Structure and taxonomy.* Beyrich, H. E. 1877.1; Claypole, E. W. 1890.2; Cope, E. D. 1885.3; Eger-ton, P. G. 1848.1, 2, 1862.1; Fritsch, A. J. 1881.1; Miller, H. 1848.1, 1857.1; Peach, C. W. 1867.1; ★Rohon, J. V. (*Morphology*) 1891.1; Whiteaves, J. F. 1880.1; Woodward, A. S. 1890.4, 1892.10. — *Restoration.* Longmuir, — 1860.1.

IV ARTHROGNATHI

Relationships of Arthrogathi. Dean, B. 1901.4. — *Reviews of Dean.* Eastman, C. R. 1901.4; Jaekel, O. 1903.1.

"ORDER" ANARTHRODIRA

Asterosteus. Newberry, J. S. 1875.1.

Macropetalichthys. — *Cranial structure.* Cope, E. D. 1891.3. — *Characteristics.* Eastman, C. R. 1897.3. — *Taxonomy.* Hennig, E. 1907.1; Kayser, F. H. 1880.2; Norwood, J. G. & Owen, D. D. 1846.1, 2.

"ORDER" ARTHRODIRA

Fishes of the Devonian and Lower Carboniferous. American forms mainly from Ohio.

General treatise, with extensive bibliography. ★Hussakof, L. 1906.1.

Morphology, taxonomy, and relationships. ★Claypole, E. W. 1890.1, 1893.6, 1894.2, 1895.3, 1896.1; Cope, E. D. 1877.4, 1891.3, 1892.1; ★Dean, B. 1901.4, 1907.1, 1909.5; Dollo, L. 1906.1, 1907.2; Eastman, C. R. 1896.1, 2; Hussakof, L. 1911.1; Kemna, A. 1904.2; Newberry, J. S. 1885.1. — *Catalogue of Dr. Clark's casts.* Clark, W. 1896.1. — *Pelvic fins.* Dean, B. 1909.5.

Mouth formation and body structure. Jaekel, O. 1907.1.

Affinities. Eastman, C. R. (to *Dipnoans*) 1906.1; Hussakof, L. 1909.2.

Popular accounts. Meyer, M. W. 1907.1; Woodward, H. 1878.1.

Brontichthys. *Structure and taxonomy.* Claypole, E. W. 1894.2; Hussakof, L. 1911.1.

Chelydophorus. *General account.* Woodward, A. S. 1889.2.

Coccosteus. *Morphology and taxonomy.* Clarke, J. M. 1893.1; Claypole, E. W. 1893.3; Hussakof, L. 1912.4; ★Jaekel, O. (*Anatomy in general*) 1902.1, Add. 1890.1; ★Koenen, A. 1876.1, 1880.1, 1890.1, 2, 1895.1, Add. 1886.1; Meyer, C. E. H. 1854.1; Pander, C. H. 1857.1; Traquair, R. H. 1890.8, 1903.2; Trautschold, H. 1880.1, 1889.1; Woodward, A. S. 1892.6.

Dinichthys. *Structure and classification.* Branson, E. B. 1908.2-1911.1; Clarke, J. M. 1885.1; ★Claypole, E. W. 1893.4, 5, 1896.2, 1898.1; ★Dean, B. 1893.1, 1896.7, 1899.1, 1909.5, 1911.3; Delafontaine, — 1877.1; ★Eastman, C. R. 1897.5, 1898.3, 1899.3, 1902.8; Hitchcock, C. H. 1868.1, 2; Huene, F. 1900.1; Hussakof, L. 1905.1, 2; Kayser, F. H. 1880.1; ★Newberry, J. S. 1868.2, 1874.1, 1878.2, 1883.1, 1884.2, 1885.3, 1888.3, 1892.1; Ringueberg, E. N. 1884.1; Sharp, K. D. 1903.1; Smith, B. 1909.2; Wright, Albert A. 1897.1.

Restoration. Branson, E. B. 1908.3; Dean, B. 1909.5.

Structure of various organs. — *Head.* Claypole, E. W. 1892.2, 3. — *Head plates.* Dean, B. 1909.5. — *Bones.* Claypole, E. W. 1893.5. — *Fins.* Clark, W. 1898.1; Dean, B. 1896.7. — *Vertebral column, fins, and ventral armoring.* Dean, B. 1896.7, 1897.2; Eastman, C. R. 1896.4; Wright, A. 1893.1. — *Dorsal shields.* Eastman, C. R. 1896.1, 2. — *Dentition.* Eastman, C. R. 1900.1; Gill, T. N. 1879.4; St. John, O. H. 1902.1. — *Skull; pineal fontanelle.* Dean, B. 1891.2. — *Muscles of jaws.* Gregory, W. K. 1915.2.

Diplognathus. *Structure and affinities.* Newberry, J. S. 1878.2, 1884.2, 1889.1.

Gigantichthys and **Onchosaurus.** *Classification.* Dames, W. B. 1889.1.

Homosteus compared with **Coccosteus.** Traquair, R. H. 1889.1. — *Taxonomy.* Woodward, A. S. 1891.4, 1916.3.

Mylostoma. *Structure and relationships.* ★Dean, B. 1893.5, 1901.4; ★Eastman, C. R. 1901.4, 1906.4; Jaekel, O. 1903.1.

Dentition. ★Eastman, C. R. 1907.2, 1909.2; Newberry, J. S. 1883.2, 1884.2.

Phlyctænaspis. — *Structure and taxonomy.* Traquair, R. H. 1890.6, 1891.1. — *Body armor.* Woodward, A. S. 1892.6.

Pholidosteus. *Description.* Jaekel, O. M. 1907.1.

Titanichthys. — *Morphology and classification.* ★Claypole, E. W. 1888.1, 1896.3; Dames, W. B. (*Cretaceous, Egypt*) 1887.2; Newberry, J. S. 1887.2. — *Dentition.* Claypole, E. W. 1892.1. — *Mounted specimen.* Dean, B. 1909.5.

Trachosteus. *Anatomy and taxonomy.* Dean, B. 1893.5, 1909.5.

Group Placodermi

Comprising papers dealing with fishes belonging to various ones of the preceding orders.

Taxonomy. — *Russia.* Eichwald, C. E. 1844.1–1853.1. — *In the Breslau Mineral-*

ogical Museum. Gürich, G. 1891.1. — *Review.* Jaekel, O. 1902.1. — *Upper Devonian, Germany.* Koenen, A. 1883.1. — *Reply to letter of Egerton.* M'Coy, F. 1848.3.

CONODONTS

Microscopic fossil teeth of an unknown family of animals ranging from the Silurian to the Lower Carboniferous. By Newberry and others these are thought to be the teeth of extinct Cyclostomatous fishes; in general they are held to belong to Annelids.

Researches on the structure and relationships of Conodonts. — *From Cambrian to Carboniferous formations.* ★Hinde, G. J. 1879.1–1900.1. — *First discovery.* ★Pander, C. H. 1856.1. — *Scotland.* Smith, John. 1900.1, 1907.1, 2. — *England and Sweden.* Volborth, A. 1861.1. — *Nature.* Young, J. 1879.1, 1880.1. — *Taxonomy.* ★Zittel, K. A. & Rohon, J. V. 1887.1.

For an extensive paper, describing new forms, reviewing the literature, and discussing affinities, see W. L. Bryant in *Bull. Buffalo Soc. Nat. Sci.*, 1921, vol. 13, no. 2, 27 p., 16 pls., and text figs.

“ . . . Index-learning turns no student pale,
Yet holds the eel of science by the tail.”

Dunciad, I, 279.

FINDING INDEX¹

- Aalesund, 467
 Abbeville, 445
 Abden Bone Bed, 533
 Abdominal arteries, 390
 Abdominal cavity, 597, 603
Abdominal Pores, 361,
 362, 608
 Aberdeen, 482
 Ablette — see *Alburnus*
 Abnormalities — see Teratology
Abramidopsis, 505, 506
Abramis, in aquaria, 377;
 embryology, 415; food of,
 492; size, 498; hybrids,
 505, 506; abnormal fins,
 603; buccal occlusion,
 604; "Mopskopf," 604;
 natural history and oc-
 currence, 635
 Absorption, 551
 Abyssinia, 421
Acantharchus, 373
Acanthias, anatomy, 368;
 brain, 385, 386; circula-
 tory system, 389, 390;
 embryology, 414; eye,
 419; head, 500; muscles,
 520; nervous system, 524,
 527; ovum, 528; in fresh-
 water, 552; viviparity,
 581; suprarenals, 598;
 abnormal dentition, 602;
 accessory fins, 603; pel-
 vic plexus, 604; proneph-
 ros, 608; visceral skele-
 ton, 612
Acanthicus, 637
Acanthocephala (parasites),
 546
Acanthocephalus, 377
Acanthodei, 398, 458, 617
Acanthodes, 550, 617
Acanthodidae, 617
Acanthopsidae, 525
Acanthopteri, 588
Acanthopterygii, **647-661**;
 anatomy, 369; in aqua-
 ria, 373 f; membranous
 labyrinth, 380; embry-
 ology, 414, 415; fin rays,
 458; food, 492, 493;
 habits, 499; ova and
 larvæ, 572; breeding, 576,
 577; sexual dimorphism,
 587; skeleton, 590; skull,
 593; taxonomy, 647
Acara, 374, 651
Acaropsis, 651
 Accessory branchial or-
 gans, 584, 585
 Acclimatization — see In-
 troduction
 Accommodation, 613, 614
Acerina, 375, 507, 550, 610,
648
Acestrorhynchus, 377
 Achanarras Quarry, 532
Achirus, 461
 Acids, 403, **551**, 552, 595;
 for preserving, 468
Acipenser, 362, 388, 398,
623; adhesive organ, 363;
 mouth, 365; intestine,
 366; anatomy, 368, 369;
 in aquaria, 373; brain,
 385, 387, 388; circulatory
 system, 390, 391; albin-
 ism, 393; scales, 401,
 402; embryology, 411-
 414; fins, 460, 461; eco-
 nomic uses, 465, 466;
 fisheries, 475; food, 492;
 heart, 502; lateral line,
 511; liver, 512; nerves,
 524, 527; olfactory or-
 gans, 527; micropyles,
 529; pancreas, 543; mi-
 grations, 552; culture,
 563; breeding habits, 576,
 577; respiratory organs,
 584; skeleton, 589; skull,
 593; spinal cord, 596;
 spleen, 597; suprarenals,
 597, 598; tactile organs,
 599; teratology, 603, 604;
 thymus glands, 605; urin-
 ogenital system, 609,
 610; vertebral column,
 611, 612
Acipenseridae, 398, **623**
Acipenseroides, 622 — see
Chondrostei
Acqui, 541
Acronurus, 572
Acrotus, 646
Actinopterygii, 401
Actinotrichia, 458
 Acustico-lateral system, 525
Adaptations, 362, 394,
 395, 493, 551, 552
 Aden, Gulf of, 435
 Adenine, 595
 Adenoid organ, 365; ade-
 noid tissue, 391
Adhesive Disk, 362, 510
 Adhesive eggs, 555
Adhesive Organs, 362 f.
 Adirondack Mts., 429
 Adolpho-Friderici, Mus.,
 519
 Adour R., 445
 Adrenal — see Suprarenal
 Adrenalin, 598
 Adriatic Sea, fauna, 448,
 449; fisheries, 480, **485**;
 plankton surveys, 571
Æoliscus, 589
 "Aesche" — see *Thymallus*
Æstivation, 363
Ætheospondyli, 612
Ætobatus, 398, 492, 581,
620
 Afghanistan, 435
 Afognak I., 562
 Africa, fauna, 363, 378,
 404, 491, **420-423**, 491,
 580; markets, 468; fish-
 eries, 475, **482**; fishing,
 489, 490; palæontology,
 532-542; fishes intro-
 duced, 556-559, 564
 Africa, British Central, 423
 Africa, British East, 421
 Africa, French Equatorial,
 421
 Africa, German East, fauna,
 421; palæontology, 536,
 540
 Africa, German Southwest,
 423
 Africa, Portuguese East,
 fauna, 421; palæontology,
 540
 Africa, Portuguese West,
 fauna, 423; palæontology,
 538
 African Lungfish — see *Pro-*
topterus
 Age, 496 — see also Growth
 Agmatine, 595
 Agoni, 517
 Agonidae, 658
Agonostomus, 379
Agonus, 375, 415, 496, 529
Agriopus, 369
 Ainsty R., 442
Air Bladder, 363, 364;
 connection with mem-
 branous labyrinth, 380;
 veins, 391; relation to
 equilibrium, 502; color,
 510; relation to nerves,
 527; parasites of, 546;

¹ Figures refer to the pages of the Subject Index, and those in black type refer to the most important reference under the subject. Headings of the main divisions of the Morphological Section are set in black type, words in italics are names of genera and species, all other names are in Roman.

- as respiratory organ, 582, 583; producing sound, 594; air volume, 601
- Air-sacs, 585
- Aisne R., 566
- Aitutaki I., 456
- Aix, 540
- Akabah, Gulf of, 435
- Akyab, 436
- Alabama, palæontology, 532, 536; fauna, 425; fisheries, 477; pisciculture, **563**, 569
- Aland Is., fauna, 451; fisheries, 487
- Alaska, fauna, 424; fisheries, 471, 473, 475; fishing, 488; pisciculture, 569
- Alba, 541
- Albania, 453
- Albany, 519
- Albermarle Sound, 563
- Albert Coal Mine, 532
- Albert Edward Nyanza, Lake, 421
- Albert Nyanza (Lake), 421
- Albinism, 393
- Albrecht (Archduke), 565
- Albufera de Valencia (Lagoon), 452
- Albula*, 594, 626
- Albulidæ, 594, 626
- Albumin, 528
- Alburnus*, **635**; in aquaria, 377; guanine, 465, 510, 511; hearing, 501; hybrids, 506
- Alcohol, effects of, 553
- Aldabra I., 437
- Aldrovandi Coll., 518
- Alectis*, 572
- Alepidosauridæ, 642
- Alepidosaurus*, 642
- Alepocephalus*, 594
- Aleppo, 439
- Aleria, 542
- Ales, 540
- Alestes*, 377, 634
- Aleutian Is., 424
- Alewite — see *Pomolobus*
- Alexandria, 421
- Alexandrovsk, 470
- Alfaro*, 376
- Algæ, 560
- Algeria, salt lakes, 406; fauna, 421; fisheries, 462, 475; palæontology, 536, 538, 540; fishes introduced, 556, 558, 559; pisciculture, 564
- Alimentary Canal, 364–367**; connection with air-bladder, 363; intestine, 365, 366; œsophagus, 365; oral cavity, 365; pharynx, 365; stomach, 365, 366; parasites of, 403, 404, 545, 546, 548; abnormalities, 603
- Alkaloids, effects of, 552
- Alkaline media, 552
- Allis Shad — see *Clupea alosa*
- Allotriognathi, 590, 625
- Alopecias* — see *Alopias*
- Alopias*, 366, 390, 496, 575, 604, **619**
- Alosa* (*A. sapidissima*), 499, 502, 504, 515, 517, 602; embryology, 415; fisheries, 474, 479; food of, 492, 493; hybrids, 507; culture, 554, 555, 562, 563, 569; introduction, 558; breeding habits, 576, 577; skeleton, 589; natural history and occurrence, 626
- Alps Mts., 452
- Alsace, fauna, 446; fisheries, 483; palæontology, 535, 536, 539, 540, 541; pisciculture, 562, 567
- Altai Mts., 436, 438
- Altamaha R., 427
- Altin, Lake, 438
- Altona, 468
- Alveoli, 522, 523
- Alvordius*, 375
- Amatitlan, Lake, 431
- Amazon R., fauna, 433, 434, 435; fishing methods, 489, 491; marine fishes in, 552
- Ambassinæ, 649
- Ambassis*, 375, 577; taxonomy, 649
- Ambi-yacu R., 438
- Ambloplites*, 373
- Amblyopsidæ, 380, 509, **643**
- Amblyopsis*, 375, 580, **643**; brain, 385, 387; ear and hearing, 501, **643**; eye, 525, **643**
- Amblypharyngodon*, 377
- Amblypterus*, 458
- Amboina I., 455
- Ameloblasts, 397
- America — see respectively Central America, North America, and South America
- American Fisheries Society, 476
- American Museum of Natural History, 519
- American Shad — see *Alosa sapidissima*
- Amia*, 365, 369, 381, 395, 401, 559, **624**; adhesive organs, 362, 363; intestine, 366; in aquaria, 373; brain, 385, 387, 388; circulation, 390, 391; embryology, 409, 410, 411, 413, 414; fins, 460, 461; economic uses, 465; food, 492; habits, 499; lateral line, 511; muscles, 520; nerves, 524, 525, 526, 527; pancreas, 543; reproduction, 576, 579; respiration, 582, 584; skeleton, 589; skull, 592, 593; sense of smell, 594; spleen, 597; suprarenals, 597; teratology, 603; urinogenital system, 609; vertebral column, 612
- Amiens, 445
- Amiatidæ — see Amiidæ
- Amiidae, 624, 649
- Amioidei, 401, 612
- Amiopsis*, 624
- Amiurus*, 364, 366, 370, 409, 415, 498, 499, 509, 512, 553, 589, 596, 605, 606, 609, **637**; in aquaria, 378; circulatory system, 389, 391; lateral line, 511; nervous system, 522, 525, 526; introduction, 556; nests, 579; suprarenals, 597, 598; fins, 603
- Ammer See, 446
- Ammocætes*, 365, 511, 543, 605, 606; anatomy, 368; membranous labyrinth, 380; brain, 385; circulatory system, 389; heart, 502; liver, 512; nervous system, 524, 525, 526; olfactory organs, 527; spinal cord, 596; excretory organs, 608; natural history and metamorphosis, 616; adult form — see *Petromyzon*
- Ammocrypta*, 648
- Ammodytes*, 385, 415, 493, 572, 645; spawning, 577, 578; respiration, 583; Tobias fish, 605
- Ammodytidæ, 645
- Amniota, 361
- Amæba mucicola* (parasiet), 550
- Amole (fish poison), 489
- Amphioxididæ, 615
- Amphioxides, 367, **615**
- Amphioxus*, 365, 366, 375, 381, 382, 383, 385, 387, 416, 418, 458, 499, 500, 512, 515, 527, 553, 575, 577, 596, 599, 606, **615**; anatomy, 367; circulatory system, 389, 391; embryology, 409–413; hermaphroditism, 504; muscles, 520; nervous system, **522**, 523, 524, 526; oögenesis, 529; respiratory organs, **584**, 585; spinal cord, 596; urinogenital system, 607; notochord, 611; visceral skeleton, 612
- Amphipnoidæ, 590
- Amphipnous*, 389, 585, 593
- Amphiprion*, 395
- Amphiptyches* (parasite), 545
- "Amphirhinie," 527

- Amphisile*, 369, 512, 572; taxonomy and occurrence, 644
Amphisilidæ, 644
Amphistidæ, 653
Amphistium, 653
Amphistomum (parasite), 545
 Amphistylic skull, 592
 Ampullæ, of labyrinth, 380; of Lorenzini, 511; of Savi, 511
 Amsterdam, 467, 518
 Amur, fauna, 438; Amur R. fisheries, 473, 480
 Amylase, 403
 Amyzon Beds, 538
Anabantidæ, 370, **646**
Anabas, 415, 580, **646**; in aquaria, 379; climbing, 512, 513
Anableps, 376, 499, 582, 642; eye, 418
 Anabolism, 551
Anacanthini, 369, 375, 415, 588, 589, **646**, **647**; food, 493; ova and larvæ, 572
 Anadromous fishes, 515
Anæmia, 545, 549
Anamnia, 361, 596
Anarrichadidæ, 369, 499, **660**
Anarrhichas, 366, 399, 609, **660**
Anarrichthys, 593
Anaspida, 664
Anatomy and Morphology, 367 f.
Anchovia, 415
 Anchovy — see *Engraulis*
 Ancona, 518
 Andaman Is., 437
 Andean Catfish — see *Arges*
 Andes Mts., 434, 435
 Andorra, 439
 Aneboda, 470, 568
 Anecdotes, 495
 Angara R., 480
 Angler — see *Lophius*
Angling, 370 f., 381; exhibits, 466, 467
 Angola, 423
 Angora, 439
 Angoulême, 536
Anguilla, 388, 503, 595, **637-641**; air-bladder, 364; anatomy, 369; in aquaria, 375; blood, 383, 384; circulatory system, 391; color, 393, 394; scales, 402; reproduction, 410, 576, 638, **639**; eye, 419; fisheries, **471**, 490; food of, 492, **493**, 639; growth, **497**, 498, 638; habits, 499, 637-641; hearing, 501; sex, 503, 504, 602, **639**; skin, 509, 510; overland migration, 513; medical use, 514; nerves, 526; diseases, 547, 548; introduction, 558, 565, 569; culture, **561**, **567**, 568; skeleton, 589; skull, 593; spinal cord, 596; spleen, 596; suprarenals, 598, 599; teratology, 602; taxonomy, 641; larval forms — see *Leptocephali*
Anguillidæ, 637-641
 Anguilliform fishes, 493
 Anjou R., 445
Anlopus, 415
 Annobon I., 422
Anomalopidæ, 649
Anomalops, 513, 514
Anoplopoma, 658
Anostomus, 377
 Antarctic, fauna, 396, 420, 571; palæontology, 405, 538
Antennariidæ, **661**; nests, 579
Antennarius, 379, 499, 579, **661**
 Anthianini, 648
 Anthrax, 404
 Antiarchi, 664
 Anticosti I., 425
Antigoniidæ — see *Caproidæ*, 590, 650
 Antigua, fauna, 430; palæontology, 538
 Antioch, Lake, 439
 Antwerp, 542
 Anus, 366, 603
 Aorta, 390, 597
 Aosta Valley, 448
Apeltes, 415
Aphredoderus, 375, 499; distribution, 647
Aphyia, 474
Apiosoma (parasite), 550
 Aplanatism, 419
 Apodes, 589, 590, **637-641**; anatomy, 369; skull, 593
Apogon, 375, **579**, 601
Apogonichthys, 395
Apomotis, 373, 647, 648
 Apophyses, 612
 Apparatus, deep-sea, 395; fisheries, 463; pisciculture, 554, 555, 564; research, 600, 601
 Appendices pyloricæ, 366
 Appendix digitiformis, 366
Aprion, 649
 Apsheron Penin., 541
 Apure R., 435
Aquaria, 372, 373; journals, 373; exhibits, 466, 467; photography, 601
 "Aquarisère," 554
Aquarium Fishes, 373 f.; behavior, 381; age, 497; hybrids, 506; luminous fishes, 513; sex-ratio, 586
 Arabia, 435; ancient Arabic writings, 504
 Aral Sea, 438
 Aramaic, 600
Arapaima, 576, **580**, 582
 Arazède, 540
 Arborescent appendages, 585
 Arcachon, fauna, 445; fisheries exhibit, 467; fish farming, 566
Arcana, 662
Archæology, 379, 605
Archamia, 579
 Arch-centra, 611, 612
 Archenteron, 412, 413
 Archer-fish — see *Torotes* and *Chelmon*
 Archinephric duct — see *Pronephros*
Archinephros, 606
 Archiplata-Archhelenis theory, 432
Archipterygium, 417, 460
Archosargus, 593, 650
 Arctic, fauna, 396, 420; fishing methods, 490; food of fishes, 493
 Arcualia, 610-612
 Ard, Loch, 565
 Area-curves, 493
 Areolar tissues, 587, 588
Argenteum, 510, 511
Argentina, 361, 572, **633**
 Argentina, fauna, 432, 433; fisheries, 479; palæontology, 533, 540, 542; fishes introduced, 557, 558; pisciculture, 570
Argentininæ, 633
Arges, 434, 435, **637**; climbing, 513
 Arginase, 403
Argulidæ (parasites), 544
Argulus (parasite), 544
Argyropelecus, 514, 522, 609
Argyrosomus, 632
 Aristotle's *Glanis* — see *Parasilurus*
Arius, 577, 579, 582; fossil forms, 636
 Arizona, 425, 426, 556
 Arjepluog, 452
 Arkansas, 426, 569
 Armagh limestone, 533
 Armisan, 541
 Armor, 402
 Arno R., 448
Arnoglossus, 587, **653**; eggs and larvæ, 654
 Arnon R., 569
 Arquà, Lake, 448
 Arran I., 443
 "Arrhenoidie," 586
 Arsus, 439
 Arterial system, 389 f.
 Artesian wells, 382, **406**, 423
Arthrodira, 589, 611, **664**, 665
Arthrognathi, 664, 665
 Articular, 592
 Artificial fertilization, 410, 555
 Artificial pearls, 510, 511 — see also Guanin

- Aru Is., 455
Ascaris (parasite), 546
 Ascension I., 420
 Ashley Phosphate Beds, 540
 Ashmolean Coll., 518
 Asia, 405, 508, 590; salt lakes, 406; fauna, 435; fisheries, 469, 473, 479; museums, 517; palæontology, 531, 533-535, 537, 541, 542; fishes introduced, 557, 558; pisciculture, 564
 Asia, Russian Central, 480
 Asmodeus, 605
 Asphyxiation, 502, 584
 Aspidocotylea (parasites), 545
Aspidogaster (parasite), 545
Aspidophorus, 609
Aspidorhynchidæ, 624
Aspidorhynchus, 624
Aspius, 377
Aspredinidæ, 377, 592, 637
Aspredo, 578
Aspro, 648
Aspropotamos R., 447
 Assemblies—see Congresses
 Associations—see Societies
 Assumption I., 437
 Assyrians, 488, 504, 521
Asterolepidæ, 664
Asterolepis, 664
Asterosteus, 664
 Astrachan, 462, 568
Astrape, 408
Astronesthes, 513
Astronotus, 651
Astroscopus, electrical organs, 407; burrowing habits, 500; nares, 527
Asymmetron, 367, 610, **615**
 Asymmetry, in caudal fin, 459; in flatfishes, 654
 Asyntaxis, 412
 Atelaxia, 661
Ateleaspidæ, 663
Ateleaspis, 663
Ateleopodidæ—see *Podatellidæ*, 660
Atherina, 415, 529, **645**; in fresh-water, 552, 645; "Mopskopf," 604; persistence of pronephros, 609
Atherinichthys, 379, 559
Atherinidæ, 645
Atherinopsis, 415, 589
 Athi R., 421
 Atitlan, Lake, 431
 Atlanta, Ga., 466
 Atlantic Ocean, fauna, **396**, 420, 571; Fisheries Dispute, 468; migrations, 515; plankton surveys, 571, 572
 Atlases, 508
 Atrato R., 434
 Atrial chamber, 584
Auchenaspis, 663
Auchenipterus, 577
Auditory Organs, **379 f.**, 591; ear, 379, 396, 501, 502, 549; membranous labyrinth, **380**, 501; Weberian apparatus, 380, 381; nerves, 525, 604
Aulastomatomorpha, 594
Aulichthys, 589
Aulorhynchidæ, 589, 644
Aulostomidæ, 589
Ausonia, 653
 Aust Cliff, 534
 Austral Is., 457
 Australia, 363, 405; aquaria, 372; fishing, 372, 489, 490; fauna, 453, 454, 513, 580, 582; fisheries, 488; museums, 517; palæontology, 531-534, 536, 538, 540, 542; fishes introduced, 557, 558, 559; pisciculture, 570
 Australian Bass—see *Per-calates*
 Austria-Hungary, 505, 508; fauna, 439, 440, 506; fisheries, 466, 469, 474, **480**; markets, 468; museums, 517; palæontology, 531, 534, 537-542; fishes introduced, 557, 558; pisciculture, 565; vernacular names, 600
 Autogeny—see Regeneration, 575
 Autostylic skull, 592
 Autun, 534
 Auximetameric skull, 591
Auris, 572
 Avesa, 539
 Avilliers, 566
 Avon R., England, 442
 Avon R., New Zealand, 457
 Axillary arteries, 390
 Axillary hearts, 597
 Axis cylinder, 523
 Azores Is., fauna, 440; fisheries, 480
 Azov, Sea of, 440
 Azygos fins, 417
 Azygos veins, 598
 Babber I., 455
 Bacilli, 404, 469, **547**, **548**
 Backbone—see Vertebral Column
 Bacteria, 404, 514, **547**, **548**, 549
Badis, 374, 577
 Bärau, 507
 Bagrinæ, 636, 637
 Bahama Is., 430, 479
 Bahia, 433, 537
 Baie des Chaleurs, 531
 Baikal, Lake, 438, 480
 Baird, Cal., 562
Bairdiella, 415
 Bait, 473, **488**, 489
 Bakonyerwald, 534
 Balangi, 538
Balanoglossus (Hemichordate), 615
 Balaton, Lake, 543, 556; fauna, 440; fisheries, 480
 Balbiani, nucleus of, 529
 Balearic Is., 440
 Bali I., 456
Balistes, **662**; skeleton, 590; sense of smell, 594; sound, 594
Balistidæ, 395, 402, 449, 574, **661**, 662
 Balkash, Lake, 438
 Baltic Provinces, fauna, 450; fisheries, 487; pisciculture, 568
 Baltic Sea, 506, 515, 543, 559, 564; fauna, 440, 446; fisheries, 471, 480, 490; food of fishes, 493; plankton surveys, 571
 Baltringen, 541
 Baluchistan, 435, 479
 Banda Is., 455
 Banff, 534
 Bangweolo, Lake, 423
 Banka I., 455
 Banks Coll., 517
 Barbados, 430, 479
 Barbasco (fish poison), 490
 Barbel—see *Barbus*
 Barbels, 498, 575, 599, 602
Barbus, 394, 415, 506, 549, 558, 574, 582, 595, 602, 609, **635**; in aquaria, 377, 378; *B. mosal*, size, 498
 Barca R., 421
 Barcoo R., 454
 Barents Sea, 420, 571
Barilius, 378
 Barometer-fish—see *Cobitis*, 381
 Barracuda—see *Sphyræna*
Barringtonia (poisonous plant), 490
 Barrow R., 442
 Barrow-on-Soar, 535
 Barrow Straits, Canada, 424
 Bartlett Coll., 370
 Base-leveling, 405
 Basking Shark—see *Cetorhinus*
 Bass, 556, 569, 647 f.—see also the various genera
Bassozetus, 385
 Batfish—see *Malthe*
 Bath, England, 517
Bathophilus, 572
Bathylchnus, 572
 Batjan I., 455
 Batoidei, 388, 403, 515, 586, **620**, **621**; anatomy, 368; dentition, 396, 398; scales, 400; embryology, 414; fins, 461, 603; economic use, 465, 466; muscles, 520; ova, 528; in fresh-water, 552; reproduction, 580, 581, 608; jaws, 592; spinal cord, 596; suprarenals,

- 597; excretory organs, 608
Batrachidæ, 659, 660
Batrachops, 651
Batrachus — see *Opsanus*
Batticaloa, 595
Batu Is., 456
Bavaria, fauna, 446; fisheries, 462, **483**; palæontology, 535, 536, 537, 539, 540; whitefish introduced, 558; pisciculture, 567
Bawean I., 455
Bay d'Along, 436
Bayonne, 444
Bayreuth, 535
Bdellostoma, 362, 365, 368, 500, 502, 510, 543, 577, 586, 596; brain, 385, 388; circulation, 389, 391; embryology, 411, 413; eye, 418; nerves, 524, 525, 526; egg cases, 528; voracity, 575; gills, 585; skull, 592; suprarenals, 598; excretory organs, 606, 607; thyroid gland, 606; reproductive organs, 607; taxonomy, 616
Bdellostomatidæ, 368, 616
Beam trawl, 463
Bear I., 420
Bear Lake, 569
Beaufort, N. C., 429, 469
 "Becherzellen," 509, 510
Bechuanaland, 421
Bederkesaer See, 446
Behavior, 381, 382
Belfast Lough, 443, 481
Belfaud, 566
Belfort, 483
Belgium, 517, 543, 554, 556; fauna, 440; fisheries, 462, 466, **480**; palæontology, 515, 531, 533, 537, **539**, 540, 542; pisciculture, 565
Belly R., 536
Belone, 499, 574, 575, **645**; color, 393; embryology, 411, 415; ova and larvæ, 572
Belonesox, 376
Belonorhynchidæ, 623
Belonostomus, 624
Benaco — see *Garda*
Bengal, 406, 436, 479
Bengal, Bay of, 437
Beraun R., 439
Bergamo, 567
Bergen, 462, 467, 470
Beri-beri, 403
Bering Sea, 396, 424
Berlin, 467, 518
Bermuda, 392, 602; fauna, 430; markets, 468; fisheries, 479
Bern, 467
Bernburg, 535
Berycidæ, 647
Berycoidea, 590
Berycomorphi, 590
Besano, 535
Besleriani, Mus., 518
Bestiaries, 505
Betta, 415, 585, **651**; in aquaria, 374; fighting, **500**; reproduction, 576, 577, 579
 "Beulenkrankheit," 549
Bhamo, 436
Biala, 565
Biarritz, 566
Bible — see *Theology*
Bibliographies, 339 f.; fishery, 462 f.; British museum, 517
Bicken, 532
Bieler See — see *Bienne, Lake of*
Bienne, Lake of, 452, 487
Big-eyed Herring — see *Elops*
Bighorn Mts., 530
Bile, 403, 512, 547, 595; chemical composition, 388
Billingsgate market, 468, 481
Billiton I., 455
Bintang I., 456
Biogenetic law, 416
Bionomics, 405, 462
Biotæcus, 651
Bipolarity, 404
Birket el Qurun (Lake), 421
Birmingham, 442
Biscay, Bay of, 444, 572
Biscayne Bay, 569
Bismarck Archip., 456, 490
Bitterling — see *Rhodeus*
Biwa Lake, 437
Blackband Ironstone, 533
Black Bass — see *Microp-terus*
Black-fish — see *Centrolo-phus*
Black Hills, S. D., 430
Black Sea, 440, 444, 480, 482
Bladder, air — see *Air-bladder*
Bladder, urinary, 609
 "Blanc d'ablette," **465**, 510, 511
Blastodisk, 411
Blastopore, 412, 413
Blauen, 540
 "Blaufelchen," 564, 558
Bleak — see *Alburnus*
Blenniidæ, 369, 373, 582, 583, **659**
Blennius, 382, 414, 579, 582, 599, **659**; in aquaria, 373; ova and larvæ, 529, 572; urinogenital system, 606, 609
Blennioidea, 660
Blenny — see *Blennius*
Blicca, 506
Bliccopsis, 506
Blind Fishes, 375, 382, 383; brain, 385; optic lobes, 387; from artesian wells, 406; skin, 509; optic nerves, 525; blindness caused by parasites, 547 — see also *Amblyop-sis, Gronias, Trogloglanis, Typhlogobius*
Blood, 383, 384, 403, 555, 597, 601, 605; circulatory system, 389 f.; blood pressure, 392; parasites and diseases of, 545, 548, **549**; physiology, 552
 "Blood islands," 383
Blood vessels, 509; of eye, 419; of central nervous system, 523; regeneration, 575
Bluefish — see *Pomatomus*
Blue Gill — see *Lepomis*
Blue Shark — see *Carcha-rias*
Bochum, 533
Bodensee — see *Constance, Lake of*
Bodo necator (parasite), 550
Body-cavity — see *Cœlom*
Bösartiger Kropf, 547
 "Bogenbildungen" — see *Visceral Arches*
Bogoslovsk, 536
Bohemia, fauna, 439; fish-eries, 480; palæontology, 531, 534, 537, 540, 541
Bohuslan, 472
Boitzenburg, 567
Boleophthalmus, 374, 418
Boleosoma, 648
Bolivia, 433
Bologna, 518
Bombay, 479, 517
Bomolochinæ (parasites), 544
Bone bed, 533
Bone-fish — see *Albula*
Bones, 397, 399, 400, 401, 458, **588, 589**, 612; age determination by, 496, 497; diseases of, 547; skeleton, 587 f.; skull, 590 f.
Bonin Is., 438
Bonito — see *Gymnosarda*
Bonn, 540
Bonnet-head Shark — see *Sphyrna*
Book of Saint Albans, 370
Boom, 540
Bootan, 500
Booth Library, 370
 "Bora Chung," 500
Borers — see *Myxinoides*
Borneo, 552, 595; fauna, 455; fisheries, 488; fish-ing, 490
Bornholm I., 535
Bosnia, 439, 480, 538
Boston, Mass., 471, 519
Botargo, 465, 472
Botcher, 629
Bothriocephalus (parasite), 546

- Bothriolepis*, 664
 Bottesford, 442
 Boulogne, fauna, 445; fisheries, 467, 483; palæontology, 536
 Bourbon I., 437
 Bouro I., 455
 Bow-fin — see *Amia*
Box salpa, 464
 Bozziano, Mus., 518
 Brahmanism, 605
Brain, 384–388, 391, 418, 501, 502, 601; of deep-sea fishes, 396; nerves, 524, 525; diseases and parasites of, 547, 549, 604; position in skull, 593; taxonomic value, 599
Brama, 653
 Bramidae, 653
 Branchial arches, 390, 416, 417, 612, 613
 Branchial arteries, 390, 392
 "Branchial basket," 612
 Branchial clefts — see Visceral clefts, 613
 Branchial hypothesis, 417
 Branchial respiration, 583
 Branchial sensory organs, 586
Branchiostoma — see *Amphioxus*, 615
 Branchiostomidae, 615
 Branchiura (parasites), 544
 Branding regulations, 471
 Brantas, R., 455
 Bras d'Or Lakes, 425
 Brazil, 508, 556, 579, 580, 583; fauna, 433, 434; fisheries, 479; museums, 519; palæontology, 531, 537, 538, 539; pisciculture, 570; vernacular names, 600
 Bream — see *Abramis*
 Breathing valves, 584
 Breeding, 505, 510 — see also Pisciculture
 Breeding grounds — see Spawning grounds, 577
 Breeding habits, 575
 Breeding seasons, 576
 Bremen, 446, 554
 Brenet, Lake, 516
 Brescia, 567
 Breslau, 518
Brevoortia, 493, 559, 626; as fertilizer, 465; fisheries, 472; migrations, 515
 Bridger, 538
 Brighton, 442, 517
 Brill — see *Rhombus lævis*
 Bristol, England, 517; Bristol Channel, 441; Bristol Coalfield, 533
 Bristol, Pa., 563
 British Columbia, fauna, 424; fisheries, 469, 475; Amyzon Beds, 538
 British Guiana, 580, 582; fauna, 434; fisheries, 479
 British Honduras, 431
 British Isles, 508, 516, 543, 548, 576; fauna, 440–444; fisheries, 466, 467, 468, 469, 471, 472, 473, 474, 480–482; markets, 468; museums, 517; palæontology, 531, 532, 433, 534, 535, 537, 539, 540, 542; fishes introduced, 557, 558; pisciculture, 565; vernacular names, 600 — see also England, Ireland, Scotland, and Wales
 British Museum, 517
 Brittany, 445, 473, 483
 Broad R., 569
Brontichthys, 664
 Brood pouch, 578
 Brora, 535
Brosmius, 572
 Brotulidae, 382, 582
 Brotulinæ, 660
 Brussels, 466, 517, 565
 Bruxellian stage, 539
Bryttus, 415
 Buccal cavity, 365
 Buccal incubation — see Oral gestation, 579
 Buccal nerve, 525
 Buccal occlusion, 604
 Bucharest — see Bukarest
 Bucksport, 562
 "Bucskalo," 490
 Budapest, 541
 Buddhism, 605
 Büddenstedt, 539
 Buenos Aires, 433
 Büsum, 446
 Buffalo, 466
 Buffalo Fish — see *Ictiobus*
 Buffalo R., 423
 Bufonites, 398, 530
 Bug R., 450
 Bugey, 536
 Buhi, Lake, 457
 Bukarest, 548
 Bulbus arteriosus, 503
 Bulbus oculi, 419
 Bulgaria, 444, 482
 Bulldog-head, 604
 Bullhead — see *Amiurus*
 Bullhead Sharks — see *Heterodontidae*
Bunocephalus, 377
 Burbot — see *Lota*
 Burgundy, 536
 Burma, 436, 539, 541; vernacular names, 600
 Burrowing habits, 500
 Bursa entiana, 366
Butirinus, 503
 Butterfish — see *Pholis*
 "Butterfly Fish" — see *Pantodon*
 Buxière-les-Mines, 533
 Cachar, 436
 Cadillac-sur-Garonne, 566
 Cæcal diverticula, 585
 Cæcum coli, 366
 Caen, 536
Cæcio, 650
 Calabria, 542
Calamoichthys, 369, 373, 380, 387, 593, 622
Calamus, 593, 650
 Calanna, 542
 "Calcaire Grossier," 539
 Calceolarii, Mus., 518
 Calcification, 588, 593
 Calculi, 388, 512, 547
 Calcutta, 517
 Caldana, 448
 Calico Bass — see *Pomoxys*
 California, 466, 554, 576; artesian wells, 406; hot springs, 406; fauna, 426; markets, 468; fisheries, 469, 471, 473, 477; palæontology, 534, 536, 540, 542; fishes introduced, 556, 557, 558, 559; pisciculture, 569
 California, Gulf of, 432
 Callao, 516
 Callichthyinæ, 637
Callichthys, in aquaria, 378; locomotion, 513; breeding habits, 576; nests, 579; sexual dimorphism, 587; skull, 592
 Callionymidae, 519, 659
Callionymus, 375, 512, 609, 659; ova and larvæ, 572; pseudo-copulation, 577
Callomystax, 594
Callorhynchus, 398, 400, 528, 580, 595, 622; anatomy, 368; eggs, 528; parasites of, 545
Callyodon, 587
 Calor animalis, 602
 Cambodia, 436, 479
 Cambridge, England, 517
 Cambridge, Mass., 519
 Cameroon — see Kamerun
 Campanula Halleri, 613
 Campbell I., 457
 Campbellton, 531
 Camptotrichia, 458
 Canada, 516; fauna, 424 f.; fisheries, 468, 471, 474; 475, 476; museums, 519; palæontology, 530, 531, 532, 534, 536, 538, 540, 542; pisciculture, 569
 Canary Is., 421, 475
 Cancer — see Carcinoma
 Candidius, Lake, 438
 Candiru, 546, 637
 Candlefish — see *Thaleichthys*
 Canelos, 434
 Cannibalism, 560
 Canning, 468, 473
Cantharus, 410
 Canyon City, 530
 Cape Blanco, 423
 Cape Breton, 424
 Cape Charles, 428

- Cape Colony, fauna, 421; fisheries, 475; palæontology, 533; fishes introduced, 558, 559; vernacular names, 600
 Cape of Good Hope, fauna, 421; fisheries, 475; luminous fishes, 513
 Cape Hatteras, 516
 Cape de la Hève, 536
 Cape San Lucas, 432
 Cape Verde, 423
 Cape Verde Is., 421, 475
 Capelin — see *Mallotus*
 Capillaries, 390
 Capo dell' Armi, 541
Capoeta, 365, 378, 510
 Capri I., 448
 Caproidæ, 590, 650
Capros, 375, 394, 499
 Caracas, 435
 Carangidæ, 590, **651**, **652**
Caranx, 363, 364, **395**, 415
 Carapace, 401
Carapus, 364, 378
Carassius, 369, 382, 391, 393, 415, 418, 459, 497, 499, 506, 520, 559, 577, 583, 596, 602, **635**; telescopic eye, 418; culture, 459, 564, **635**; hybrids, 505, 506; plates of, 508; diseases, 548; introduction, 570
 Carboniferous fossil fishes, 532
Carcharias, 366, 603; anatomy, 368; dentition, 398; size, 498; voracity, 574; skull, 591; fossil species, 618
 Carchariidæ, 618
Carcharodon, anatomy, 368; dentition, 397; embryology, 413; size, 498; voracity, 574; viviparity, 580, 581, 582; fossil forms, 619; occurrence, 619
 Carcinoma, 547
 Cardigan Bay, 444
 Caribe — see *Serrasalmo*
 Caribbean Sea, 434
 Carinthia, 439, 480, 534
 Carnegie Mus., Pittsburgh, 519
Carnegiella, 377
 Carniola, 439, 480, 565; vernacular names, 600
 Caroline Is., 456, 489
 Carotid arteries, 390
 Carp — see *Cyprinus*
 Carpathian Mts., 539
Carpio, 506
 Cartilage, 388, 417, 458, 587, **588**, 589, 590, 593, 611, 612, 613
 Casamance R., 423
 Casco Bay, 428
 Caspian Sea, 493, 515; fauna, 440, 450; fisheries, 470, 472, **486**
Caspiomyzon, 515
 Castalia Springs, 569
 Castel Gandolfo, Lake, 557
 Castell Arquato, 542
 Castellavazzo, 538
 Castel Madama, 539
 Castelnaudary, 444
 Castration, 555
 Castries, 541
 Castro dei Volsci, 541
 Catacombs, of Rome, 379, 605; of Paris, 566
 Catadromous fishes, 515
 Catalonia, 540
 Catania, 451, 516
 Cataphracti, 590
 Cataract caused by parasites, 547
 Catfishes — see *Siluridæ*
Catla, 492
 Catopteridæ, 623
 Catostomi, 643-645; anatomy, 369; in aquaria, 375; embryology, 415; skeleton, 589
 Catostominae, 635
Catostomus, 576, 596, 604
 Catskill Mts., 429
 Cattegat, 444
Caturus, 624
 Cauca R., 434
 Caucasus, 450; Caucasian Museum, 519
 Caudal intumescence, 596
Caularchus, 590, 609
Caulolatilus, 649
 Cava Meckelii, 592
 Cave fishes, 427, 439, 443 — see also *Blind Fishes* and *Amblyopsidæ*
 Caves, 379
 Caviar, 474
 Cayuga Lake, 429
 Ceará, 433, 537
 Cedar Keys, 427
 Celebes, 455
 Cell-accumulation hypothesis, 417
 Cement organs, 362
 Cenozoic fossil fishes, 538-542
 Centennial Exposition, Cincinnati, 466
 Centennial Exposition, Nashville, 466
 Centra, 610-612
 Central America, 423, 431, 556
 Centrarchidæ, 366, 499, **647**, 648; in aquaria, 373; nests, 579; taxonomy, 647
Centrarchus, 373
Centrina, 368, 581, 608, 619
 Centriscidæ, 589, **644**
Centriscus, 369, 402, **644**
Centrolophus, 366, 370, 572, 603; natural history and occurrence, 646
Centronotus, 572, 609
Centrophorus, 368, 595, **619**
 Centropominae, 649
Centropristis, 497, 566
Centroscymnus, 387
 Centrosome, 410
Cephalacanthus, larval form, 572, **659**; adult form — see *Dactylopterus*
 Cephalaspidæ, 663
Cephalaspis, 663
 Cephalochordata, **615**; anatomy and morphology, 367; distribution, 405; embryology, 413; fins, 459; habits, 499; hermaphroditism, 504; urinogenital system, 607; vertebral column, 611
Cephaloptera, 584, **621**
Cephalopterus, 418
Cephaloscyllium, 509
Cepola, 649
 Cepolidæ, 649
 Ceram I., 455
Ceratis, 590, 661
 Ceratiidæ, 661
 Ceratodontidæ, 368, **624**, **625**
Ceratodus, 367, 417, 460, 461, **624**; dental plates, 398 — see also *Neoceratodus*
 Ceratohyal, 521
Ceratoptera, 574, 593, 621
 Ceratotrichia, 458
 Cerebellum, 387, 604
 Cerebral hemispheres, 386
 Cerebro-spinal ganglia, 522
 Cerebrum, 386
 Céreste, 541
 Cerin lithographic stone, 536
 Cernaysian conglomerate, 539
 Cerros I., 425
 Cestoda (parasites), 544, **545**, **546**
Cestracion — see *Heterodontus*
 Cestraciontidæ, 362 — see *Heterodontidæ*
 Cetominidæ, 642
 Cetorhinidæ, 619
Cetorhinus, 365, 398, 492, **619**; oil, 466; claspers, 581; branchial arches, 613
 Cetto, 445, 470
 Ceylon, 493, 556, 580, 595; fauna, 435; fisheries, 479; museum, 517; pisciculture, 564
 Chad, Lake, 421
Chænichthys, 659
Chænobryttus, 507
Chærops, 651
Chætobranchopsis, 651
Chætobranchus, 651
Chætodipterus, 415
Chætodon, 373, 399, 572, **650**
 Chætodontidæ, 373, **650**
 Chagos Is., 437
Chalceus, 634

- Chalouf, 540
 Chalut, 463
 Champlain, Lake, 429, 563, 570
 Chandane, 540
 Channel Is., 441, 481
 Channel Is., Calif., 426
 Chapala, Lake, 432
Characidium, 377
Characinidæ, 402, 491, 492, 579, 585, **634**; anatomy, 369; in aquaria, 377; skeleton, 589; skull, 594
Characodon, 376, 580
Charax, 505
 Charleston, S. C., 430
 Charmouth, 535
 Charr — see *Salvelinus*
Chauliodus, 572, 594, 609; luminous organs, 514; occurrence and taxonomy, 633
Chaunax, 402
Cheirolepidæ, 622
Cheirothrix, 491
 Chelan, Lake, 430
Chelmon, 500
Chelæthiops, 378
Chelydophorus, 664
 Chemical sense, 594
Chemistry, 388 f.
 Cherrystone, Va., 570
 Chesapeake Bay, 428, 478
 Chester R., 569
 Chester tidal hatching box, 555
 Chiasma, 525
Chiasmodon, 492, 645
Chiasmodontidæ, 645
 Chiavon, 541
 Chicago, 463, 466
 Chihuahua, 432
 Chile, 468; fauna, 434; fisheries, 466, 479; museums, 519; palæontology, 538; fishes introduced, 558, 559; pisciculture, 570; vernacular names, 600
Chilobranchus, 415
Chilodipterinæ, 579, 649
Chilodus, 377
Chiloscyllium, 577
 Chilpate (fish poison), 489
Chimæra, 390, 401, 411, 492, **621**; alimentary canal, 365, 366; anatomy, 368; brain, 385, 387; lateral line, 511; nerves, 523, 524, 525; pancreas, 543; parasites of, 543, 545; sexual dimorphism, 586; spermatogenesis, 596; spinal cord, 596; suprarenals, 597; urinogenital system, 607, 608; vertebral column, 611
Chimæridæ, **621**; morphology, 368; dentition, 397, 398; fossil forms, 398, 401, **621**; dermal skeleton, 400, 401; reproduction, 414, 581, 595; egg cases, 416, 528; heart, 503; osteology, 589; skull, 612
Chimarrichthys, 659
 China, 504, 508, 521; fauna, 435, 436; fisheries, 467, 479; fishing methods, 488, 489, 490; pisciculture, 564
 China Sea, 489
 Chinchas Is., 435
Chirocentridæ, 626
Chirodon, 377; taxonomy, 634
Chirolophis, 414
Chironectes — see *Antennarius*
Chirosoma, 645
Chirothricidæ, 642
 Chitral, 436
Chlamydoselachidæ, 617, 618
Chlamydoselachus, 368, 385, 390, 459, 500, **617, 618**; dentition, 397, 398; nervous system, 524, 526; viviparity, 581; skeleton, 589; skull, 593; pronephros, 608; visceral skeleton, 612, 613
Chlopsis, 369, 572
Chlorophthalmus, 415
 Cholera, transmission, 403, 404
Chologaster, 643
Chomatodus, 397
Chondracanthidæ (parasites), 544
Chondrocranium, 591, 592
Chondrostei, 622, 623; dentition, 398; fins, 461; nervous system, 523; skeleton, 589; skull, 593; urinogenital system, 609; vertebral column, 611, 612
Chondrosteidæ, 623
Chondrostoma, 378, 506, **635**; teratology, 604
 Chorda-centra, 611, 612
 Chorda tympani, 525
 Chordal sheath, 610, **611**, 612
Chorisochismus, 609
 Choroid, **419**, 613; choroid plexus, 385; choroid fissure, 418; choroid gland, 419
 Christian Malford, 535
 Christiania — see *Kristiania*
 Christian fish symbol, 605
 Christmas I., 455
 Chromaffin tissue, 598
 Chromatophores, 393, 394, 509
Chromidæ — see *Cichlidæ*
 Chromophil tissue, 597, 598
 Chromosomes, 505, 529, 586
Chrosomus, 378, 577
Chrysichthys, 378
Chrysophrys, 375, 503, 650
 Chub — see *Mylocheilus*
 Chusan I., 435, 436
Cichla, 374, 651
Cichlasoma, 576, 587; in aquaria, 374; taxonomy, 651
Cichlidæ, **651**; in aquaria, 373, 374; oral gestation, 579, 580
 Cicott Lake, 427
 Ciguatera, 574
 Ciliary muscle, 614
 Ciliata (parasites), 550
 Cincinnati, 466, 519
Circulatory System, 389 f., 393, 418, 515, 542, 596, 601; artificial circulation, 552, 601; deformations, 603
 Circuli, 402
 Circulus cephalicus, 390
 Cirolaninæ (parasites), 544
 Cirrhitinæ, 649
 Cisco — see *Argyrosomus*
 Citharininæ, 634
Citharinus, 585
 "Civelles," 389
 Clackamas R., 429, 569
 Cladistia, 622, 623
Cladodontidæ, 616
Cladodus, 398
Cladoselache, 418, 458, 520, 616
Cladoselachidæ, 616
Clarias, 366, 394, 512, 513, 609; in aquaria, 378; arborescent appendages, 585; skull, 594
Clariinæ, 636
 Clark's "self-picking" jar, 555
Clarotes, 370
 Claspers, 400, 401, **580, 581**
 Classification — see *Taxonomy*, 599
 Claustrum, 380
 Clavate cells, 509, 510
 Clavicle, 550
 Clear Lake, 425
 Cleavage, 409, **410, 411**, 505; products, 595
 Cleithrum, 550
 Cleveland, 569
 Climate, 602
 Climbing, 513
 Climbing Perch — see *Anabas*
 Clingfish — see *Lepadogaster*
Clinostomum (parasite), 545
Clinus, 410, 579, 582
 Clipperton I., 431
 Cloaca, 361, 363, 608, 609; embryonic, 609
Clorophthalmus, 572
 Club cells, 509, 510
Clupanodon, 369
Clupea, 363, 385, 492, 511, 525; anatomy, 369; em-

- bryology, 410, 413, **415**;
 growth, 497; hybrids,
 507; culture, 562, 563;
 reproduction, 576, 577,
 609; Caspian and Volga
 forms, 627; fossil forms,
 627
Clupea alosa, 516; fisheries,
 474; food of, 492, 493;
 hybrids, 507; culture,
 563, 566, 569; natural
 history, 626
Clupea finta, 516; fisheries,
 474; food of, 492, 493;
 culture, 562, 563, 569;
 ova and larvæ, 572;
 natural history, 626, 627
Clupea harengus, 388, 413,
 465, 469, 499, 507, 574,
 595, **627**; economic uses,
 465, 466; fisheries, **471**,
472, 484, 602; as white-
 bait, 474; food of, 493;
 growth and age, 496,
 497, **627**; hermaphro-
 ditism, 504; medical use,
 514; migrations, 515,
627; ova and larvæ, 559,
 572; culture, **562**, 568;
 breeding habits, 577, 578;
 races of, 610, **627**; dis-
 tribution, **627**; natural
 history, 627
Clupea pilchardus, **627**;
 fisheries, **473**, **474**; food,
 493; growth, 496; habits,
 499; hybrids, 507; mi-
 grations, 515; variation,
 610; immature form —
 see Sardine
Clupea sapidissima — see
Alosa sapidissima
Clupea sprattus, fisheries,
474; growth and age,
 497; migrations, 515;
 parasites of, 544; natural
 history and occurrence,
 627
 Clupeidæ, 589, 612, **626**,
627; air bladder, 364;
 membranous labyrinth,
 380; age, 497; migra-
 tions, 515; ova and larvæ,
 572; respiratory organs,
 585; skull, 594
 Clupeinæ, 626, 627
Clupeonella, 497
 Clyde, Firth of, 443
 Clyde R., 443
Cnesterodon, 376, 582
 Coal measures — see Car-
 boniferous fossil fishes
 Cobia — see *Rhachicentron*
 Cobitidæ, 364, 381, 612
 Cobitidinae, 636
Cobitis, 361, 365, 366, 369,
 388, 415, 509, 595, **636**;
 in aquaria, 378; as
 weather-fish, 381; age,
 497; reproduction, 576,
 577; intestinal respira-
 tion, 583; gills, 585;
 sexual dimorphism, 587;
 teratology, 603, 604
 Coccidiidea (parasites), 548
 Coccosteomorphi — see Ar-
 throdira
Coccosteus, 664
 Cochín China, 436
 Cochlea, 380
 Cochliodontidæ, 398, 618
 Cockroaches, 555
 Cocoon, 363
 Cocos I., 431, 437
 Cod — see *Gadus morrhua*
 Codex Ricardiano, 505
 Codfish emblem, 471
Cæcobarbus, 383
 Cælaecanthidæ, 460, 551,
622
Cælaecanthus, 461, 622
 Cælepidæ, 663
 Cælom, 545, 585, 598, 607,
 609, 610
 Coimbra, 518
Coius, 370
 Cold, effects of, 601, 602
 Cold Spring Harbor, 563,
 570
 Cole Coll., 518
 Cole-Egerton Coll., 517
 Coleman Library, 370
 Collagen, 402
Collection, **392**, 554
 Collections, deep-sea, 396;
 teratological, 602 — see
 also Museums
 "Colline de Turin," 541
 Colne R., 516
 Coloboma, 418
 Colombia, 434
 Colombo Mus., 517
 Color perception, 381
 Colorado, fauna, 426; fish-
 eries, 477; palæontology,
 530, 531, 535, 536, 538,
 540, 542
 Colorado R., 426, 430, 556
Coloration, 366, 388,
392 f., 514, 524, 551;
 deep-sea fishes, 396; in-
 visibility, 396; of scales,
 401; electricity, 407; red,
 469; of hybrids, 505; of
 skin, 509; argenteum,
 510, 511; of suprarenals,
 598; temperature effect
 on, 601, 602; patterns,
 610; of flatfishes, 654
 Columbia R., 430, 473
 Colwick Wood, 534
 Comacchio, Lake, 447, 548;
 marine fish-farming, 567
 Comen, 537
 Comephoridæ, 582, **658**
Comephorus, 363, 415, 582,
658
 Commander Is., 438
Commensalism and
Symbiosis, **394** f.
 Commentry, 534
 Commerce — see Fisheries
 Commissioners, 468, 476
 Commissions, 462, 463, 476
Commissura infima, 385,
 593
 Coma, Lake, 447, 484
 Compendia, 494, 495
 "Compleat Angler," 370
 Compressiform type, 493
 Concarneau, laboratory,
 470; pisciculture, 562
 Concrescence theory, 413
 Condore I., 436
 Condroz, 531
 Cones, 419
Conger, 369, 419, 498, 503,
 514, 603, **638**, **639**, **641**;
 — see also *Leptocephali*
 Conglomerate, 539
 Congo — see Kongo
 Congresses, fisheries, 463,
 478; pisciculture, 566
 Conilera, 544
 Connecticut, fauna, 426;
 fisheries, 474, **478**; mu-
 seums, 519; palæontol-
 ogy, 534
 Connecticut R., 602
 Connective tissues, 412,
587, **588**
 Conodonts, 665
Conorynchos, 580
 Conservation, 477, 481
 Constance, Lake, 452, 453,
 487, 488, 633
 Constantinople, 468, 569
 Contact organs, 510
Conus arteriosus, 503
 Cook Is., 456
 Coosa R., 563
Copeina, 377, 634
 Copenhagen, 463, 518,
 539
 Copepoda (parasites), 543
 Coprolites, 367
 Copulation, 400, 401, **580**,
581; pseudo-copulation,
 576, 577; intromittent
 organs, 582
 Coracoid, 550
 Coral, 393, 513, 559
 Coralline crag, 542
 Coregoninæ, 411, **632**, **633**
Coregonus (both American
 and European species),
 361, 364, 386, 587, 596,
632, **633**; in aquaria,
 378; larvæ, 415; fisheries,
474, 476; food, 493, 564;
 dwarfs, 498; introduc-
 tion, 558, 569; culture,
564, 568; breeding habits,
 576 — American species,
 476, 499, 516, 544, 564,
 569; European species,
 369, 399, 568, 589
 Corfu I., 447
Coris, 375, 587
 Corium, 509, 510
 Cormorant fishing, 488
 Cornbrash, 535
 Cornea, 419, 420, 547
 Cornifications, 510
 Coronary arteries, 390
 Corps vitellin, 529

- Corpuscles of Stannius, 597, 598
 Corpus luteum, 608
 Corpus restiforme, 387
 Corpus striatum, 386
Corrigenda, 354 f.
 Corsica, 444, 483, 542
 Cortex, 597, 598, 599
 Cortical glands, 599
 Cortical tissue, 597
Corvina, 650
Corydoras, 378, 577, 587; taxonomy, 637
Coryphæna, 418, 488, 490, **653**
Coryphænidae, 653
 Cosmine, 401
 Costa Rica, 431
Costia necatrix (parasite), 550
 Costiasis, 550
 Côte-d'Or, 445
Cottidae, 374, **658**
Cottocomephorus, 658
 Cotton States Exposition, 466
Cottus, 394, 496, 498, 523, 550, 572, 609, **658**; in aquaria, 374; embryology, 415; habits, 499; migrations, 516; nests, 579; "Mopskopf," 604
 Counting devices, 554
 Courland, 450
 Courtship, 577, 578
 Crab-eater — see *Rhachicentron*
 Crag Beds, England, 542
 Crag d'Anvers, 542
 Craig Brook, 562
 Cranial muscles, 520, 521
 Cranial nerves, 524, 525, 526
 Craniata, 385, **615 f.**
 Cranium — see Skull
 Crappie — see *Pomoxys annularis*
 Crater Lake, 429
 Creatine, 389
 Creatinine, 389
 Creation, 605
Cretochanes, 377
Cremnobates, 392
 Cremona, 518
Crenacara, 651
Crenicichla, 374, 651
Crenilabrus, 393, 543, 577
 Crescent Lake, 430
 Crespano, 538
 Cretaceous fossil fishes, 536–538; egg-cases, 528
 Crimea, 450, 538
Cristæ acusticæ, 380
Cristiceps, 410
Cristivomer, 558
 Croatia, 439, 480, 540, 541
Cromeria, 589
 Croonian Lecture, 591
 Cross-fertilization, 505, 582
Crossophilis, 623
Crossopterygii, 362, 401, 585, **622**; fins, 460, 461; skull, 593; urinogenital system, 609
 Cruive, 463
 Crustacea, as parasites, 543, 544; as food, 555
Cryptogonimus (parasite), 545
 Crystalline lens, 388, **419**, 575, 603
Crystallogobius, 529, 572, **657**
Ctenodontidae, 624
Ctenodus, 624
Ctenoidei, 399
Ctenolabrus, 596
Ctenops, 375, 595
 Cuba, 468, 556; fauna, 431; fisheries, 473, 479; palæontology, 538
Cubiceps, 646
 Cuitzeo, Lake, 432
 Culham, 535
 Cullercoats, 469
 Cumberland R., 427
Cupula terminalis, 380, 511
 Curaçao I., 431, 479
 Curare, 366, 407, **553**
Curimatus, 634
 Curing fish, 468
 Currents, 405, 406; influence on migrations, 515; influence on distribution, 571
 Cusps — see Dermal denticles
 Cutaneous sensory papillæ, 509
 Cuticle, 510, **611**
 Cutis vera, 509, 510
 Cutlassfish — see *Trichiurus*
 Cutrò, 541
 Cuvier, types, 518
Cyathaspis, 663
Cybium — see *Scomberomorus*
Cyclamen (poisonous plant), 490
Cyclochæta (parasite), 550
 Cyclochætiasis, 550
Cyclogaster, 576, 658
Cyclogasteridae, 393
Cycloidei, 399
 Cyclopia, 603
Cyclopium — see *Arges*
Cyclopterichthys, 658
Cyclopteriidae, 658
Cyclopterus, 385, 399, 402, 415, 492, 499, 509, 511, 572, 596, **658**; adhesive disk, 362; anatomy, 369; nests, 579; skull, 593
 Cyclostomata, abdominal pores, 361; alimentary canal, 365, 366; anatomy, 367, 368; in aquaria, 373; auditory organs, 380; blood, 383; brain, 385, 386, 387; circulation, 389, 390, 391; dentition, 397, 398; dermal skeleton, 399; eggs, 410, 411, 413, 414, 528, 529; eye, 418; fins, 457, 459; head, 500, 515; hermaphroditism, 503; integument, 510; muscles, 520; nervous system, 522, 523, 524, 526; olfactory organs, 527; pancreas, 543; reproduction, 576, 577, 607; skeleton, 588, 589; skull, 592; spinal cord, 596; suprarenals, 598; thyroid gland, 606; vertebral column, 611; visceral skeleton, 612; natural history, taxonomy and distribution, **615 f.**
Cyclothone, 369, 385, 514, 524
Cymatogaster, 529
Cymothoidæ (parasites), 544
Cymothoinæ (parasites), 544
Cynoglossus, 365, 527
Cynolebias, 376, 587, 643
Cynoscion, 414, 497, 512, 547, 650
 Cypress Hills, 540
 Cyprinidæ, **634–636**; air-bladder, 364; alimentary canal, 365, 366; anatomy, 369; in aquaria, 377, 378; auditory organs, 380, 381; eye, 383, 418; brain, 583; color, 392, 394; pharyngeal teeth, 399; scales, 402; embryology, 412, 415; hermaphroditism, 503; hybrids, 505, 506; "pearl organs," 510; parasites and diseases, 545, 548; pectoral girdle, 550; reproduction, 577, 582; skeleton, 589; skull, 594; suprarenals, 598; kidney, 609; vertebral column, 618
 Cyprininae, 635
Cyprinodon, 376, 394, 582
Cyprinodontidae, 418, 510, 512, 595, **642, 643**; air-bladder, 364; anatomy, 369; in aquaria, 375, 376; as mosquito destroyers, 404, 559; hybrids, 409, 506; sex, 409, 586; viviparity, 582; respiratory organs, 585
Cyprinus, 401, 404, 490, 550, 556, 576, 596, **635**; aestivation, 363; anatomy, 369; embryology, 410, 415; food, 493; growth and age, 496, **498**, 635; gustatory organs, 498; hermaphroditism, 504; hibernation, 504; hybrids, 506; skin, 509; lateral line, 511; nerves, 522, 525; diseases and parasites,

- 545, 547, 548, 549; introduction, 556, 558, 564, 570; culture, **561**, 564, 565, 567, 568, 569; skeleton, 589; jaws, 592; sense of smell, 594; spinal cord, 596; teratology, 602, 603, **604**; as food, 635; fossil form, 635; varieties, 635
Cystidicola (parasite), 546
 Cysts, 547, 550
Cyllus, 653
 Czirknitzer See, 480
- Dab — see *Pleuronectes limanda*; Lemon Dab — see *P. microcephalus*
 Dachel Oasis, 536
 Dactylopteridæ, 659
Dactylopterus, 364, 572, **659**; larval form — see *Cephalacanthus*
 Dahomey, 422
Dallia, 589, 642
 Dalliidæ, 642
 Dalmatia, 439, 480, 537
 Danau Sring, Lake, 455
Danio, 382, 415; in aquaria, 378
 Danish Deep-Sea Commission, 482
 Dantzig, 531, 532, 567
 Danube R., fauna, 439; fisheries, 480, **486**, 490; fishes introduced, 557, 558; eel in, 558, 561; pisciculture, 565
Dapedius, 623
 Dasyatidæ — see Trygonidæ, 620
Dasyatis — see Trygon
Dasybatus — see Trygon
 Dauphiné, 445, 566
 Davidson's method, 392
 Dealfish — see *Regalecus*
 Deccan, 535
 "Deckknochen," 592
 Decomposition, 469
 Deep-Sea Commission, 482
Deep-sea Fishes, **395**, **396**, 516, 551; auditory organs, 380; luminosity, 381; brain, 385; color, 392, 396; of the Pacific, 431; food of, 492; size, 498; vision, 613
 Delaware, fauna, 426; fisheries, 474, 478; pisciculture, 563, 569
 Deluge, 605
 Dendrodontidæ — see Holoptychidæ, 622
 Denée, 533
 Denmark, 462, 552; fauna, 444; fisheries, 470, 471, 472, 473, **482**; museums, 518; palæontology, 535, 539; pisciculture, 565
 Density, 552
 Dentary, 521
Dentex, 613, **650**
 Dentine, 397, 399, 400, 459, 588
Dentition, **397** f., 416, 586; fossil teeth, 498, 530; venomous apparatus, 573; taxonomic value, 599; abnormal, 602
 Denton Brothers' taxidermic method, 392
 Departure Bay, 469
 Depletion of fisheries, **464**, 481
 Depressiform type, 493
 Depth organ, 387
 Dercetidæ, 643
Dermal Skeleton, 397, **399** f., 458, 588; shagreen, 397, **402**, 458
 Dermatomykosis, 550
 Dermis, 402, 509, 510
 Dermotrichia, 458
Derris (poisonous plant), 490
 Descemet's membrane, 420
 Detroit R., 564
 Deutscher Seefischerei-Verein, 483
 Development, 381, 413
 Devil-fishes — see *Ceratoptera*, *Manta* and *Mobula*
 Devil's Lake, 429
 Devonian fossil fishes, 368, 518, 519, **531-532**, 663, 664
 Diaphragm, 503
 Diastase, 403
Dicerobatis, 385, 584, 620, 621
 Dichelesthiidæ (parasites), 543
 Dictionaries, 494, 495, 601
Didymaspis, 663
 Diencephalon, 386
 Dieppe, 445
Digestion, **403**
 Digestive system, abnormal, 603
 Digitiform appendages, 461
 Dijon, 566
 Dimorphism — see Sexual Dimorphism, 586
Dinichthys, 398, 520, 611, **664**
Dinolestes, 590
Diodon, 574, 590; skin used for helmets, 402, 403, 464; inflation, 500; fossil forms, 662
 Diodontidæ, 402, **662**
 Diphyccery, 459, 460
Diplaspis — see *Cyathaspis*
Diplodus, 593, 650
Diplognathus, 664
 Diplostomiasis, 545
Diplostomum (parasite), 545
 Dipneusti — see Dipnoi
 Dipnoi, **624** f.; abdominal pores, 361, 362; air-bladder, 363, 364; alimentary canal, 365, 366; anatomy, 368, 624; fossil forms, 368, **624**; in aquaria, 373; auditory organs, 380; blood, 383; brain, 385; circulation, 389, 390, 391; dentition, 398, 416; scales, 399, 402; embryology, 411, 414; skull, 416, 592, **593**; eye, 418; fins, 457, 458, **460**, 461; habits, 499; head, 500; heart, 502; liver, 512; muscles, 520; nerves, 523, 524, 526; ovum, 529; pancreas, 543; pectoral girdle, 550; pelvic girdle, 551; physiology, 553; breeding habits, 576; respiration, 582, 584, 585; skeleton, 589; suprarenal organs, 598; urinogenital system, 607, 608; vertebral column, 611, **612**
 Dipteridæ, 401
Dipterus, 625
Diptychus, 635
Dirca (poisonous plant), 489
Disceus, 368
 Discocephali, 657
 Diseases of animals, 404
 Diseases of fishes — see Pathology, 546 f.
Diseases of Man, **403** f.
 Disko Bay, 425
 Displacements, 493
 Dissection, 601
 Distichodontinæ, 634
Distichodus, 634
 Distomatosis, 404
Distribution, **404** f.; vertical or bathymetric, 393, 395, 405; deep-sea fishes, 395 f.; pelagic fishes, 551, 571; of specific fishes — see Systematic Section — see also Fauna, 419
 District of Columbia, 426, 519, 569
Distomum (parasite), 545
 Diving, 490
 Diving goose, 488
 Djoua, 536
 Dnieper R., 450
 Dniester R., 440, 450
 Dobrudja, 450
 Dodder R., 443
 Dogfishes — see Scylliidæ
 Dogger Bank, 559
 Dohrn's sinus, 389
 Dohrn's theory, 365
 Dolphin, aid in fishing, 488, 490 — see also *Coryphæna*
 Dominica, 431
 Don R., 450
 Dongargaon, 539
 Donja Dolina, 439
 Don Quixote, fishes in, 451, 504
 Doradinæ, 637
Doras, 364, 579, 612; locomotion, 513
Dormitator, 374

- Doryichthys*, 375
 "Dotterkern," 529
 "Dotterorgan," 411
 "Dotterstrang," 413
 Double embryos, 413
 Double monstrosities, 604, 605
 Dour, 531
 Dove Marine Laboratory, 469
 Dover, 537
 Drag seine, 463
 Dragonet — see *Callionymus*
 Dredging, 476, 477
 "Drehkrankheit," 549
Drepanaspidæ, 663
Drepanaspis, 663
 Drugs, 552, 553
 Drumfish — see *Pogonias*
 Drying, 468
 Dscha R., 422
 Dublin, 518
 Ductless glands, 597, 605, 606
 Ductus Cuvierii, 391
 Ductus cysticus, 512
 Ductus endolymphaticus, 380
 Ductus pneumaticus, 363, 364
 Duero R., 449
 Duisburg, 447
 Dumbleton, 535
 Duna R., 450
 Dunbar Marine Hatchery, 482, 561
 Dunedin, N. Z., 480
 Duodenal segment, 366
 "Duplicities," 604, 605
 Dura Den, 532
 Dutch East Indies, fauna, 454 f.; fisheries, 488; palæontology, 538, 542; pisciculture, 570; poisonous fishes, 574 — see also East Indies
 Dutch Guiana, fauna, 434, 435; fisheries, 479
Duymaeria, 393
 Dwarf fishes, 498, 602
 Dynamite, 488, 489
 Dynamometer, 601
 Eagle Rays — see *Myliobatidæ*
 Ear, morphology, 379 f.; membranous labyrinth, 380, 501, 502; of deep-sea fishes, 396; functions, 501, 502; otoliths, 527; parasites, 549
 "Ear stones," 527
 Earlston, 532
 Earthquakes, 516
 East Friesian Is., 446
 East Indies, 508, 582; industries, 465, 466, 568; fishing, 489, 490 — see also Dutch East Indies
 Eastbourne, 442
 Easter I., 456
 Ebro R., 452
Ecbasis captivi, 505
 Ecce shales, 532
Echeneididæ, 593, 657
Echeneis, 394, 399, 459, 493, 657; adhesive disk, 362; symbiosis, 395; fishing with, 490; shipholder myth, 521
Echidion — see *Fierasfer*
Echinorhinus, 368, 385, 524, 612; occurrence, 619, 620
Echinorhynchus (parasite), 546
Ecology, 394, 405 f., 498, 552; deep-sea, 396
 Ectoderm, 362, 412, 509, 510, 586, 589, 607
 Ectoparasites, 543, 544, 545, 550
 Ecuador, 434
 Edestidæ, 618
Edestus, 618
 Edinburgh, 467, 518
 Eel R., 427
 Eels — see *Anguillidæ*;
 Electric Eel — see *Gymnotus*
 Eggs — see Ova and Ovum
 Egg-cases, 528, 602
 "Egg-cells," 547, 602
 Egypt, 372, 468, 504, 521; fauna, 421; fisheries, 475; palæontology, 536, 538, 540, 542
 Eichstädt, 536
 Eifel chalk, 532
 Einsiedel, 565
 Eisleben, 534
Elacate — see *Rhachicentron*, 415, 652
Elacatidæ — see *Rhachicentridæ*
Elasmobranchii, 616–621; abdominal pores, 361, 362; head cavities, 362; anatomy, 368; in aquaria, 373; auditory organs, 380; blood, 383; brain, 385, 386, 387; circulation, 390, 391, 392; dentition, 397 f.; fossil forms, 398, 616; dermal skeleton, 400, 402; embryology, 410, 411, 412, 413, 414; eye, 418; fins, 458, 459, 460, 461; gustatory organs, 498; size, 498; habits, 499; heart, 502, 503; lateral line, 511; liver, 512; myology, 519, 520; nervous system, 522, 523, 524, 525, 526, 527; ova and ovum, 528, 529; pancreas, 543; pectoral girdle, 550; pelvic girdle, 551; reproduction, 580, 581; respiration, 583, 584, 585; skeleton, 588, 589; skull, 593; spermatogenesis, 596; suprarenals, 597, 598; thymus glands, 605; thyroid gland, 606; urinogenital system, 608; vertebral column, 611, 613
 Elastic fibers, 502
 Elastic tissues, 587, 588
Elastica externa, 611
Elastica interna, 611
 Elba I., 448
 Elbe R., 446, 483, 563
 Elbeuf, 518
 Electric Rays — see *Torpedinidæ*
Electrical fishes, 406, 407, 408, 586, 601; electrical organs, 388; color, 392; medical use, 408, 514; effect of curare, 553
 Electro-cardiography, 601
 Electrolysis, 407
Electrophorus, 634 — see also *Gymnotus*
Eleotridinæ, 657
Eleotris, 374, 577
 Ellice Is., 456
 Elobey I., 422
Elopidæ, 594, 625
Elops, 625
 Elver — see *Anguilla*, 639
Embiotocidæ, 409, 582, 583, 651
Embryology, 383, 406, 408 f., 413 f., 417, 418, 494, 520, 575, 580, 581, 585, 588, 599, 609, 628; circulation, 389, 390, 601, 603; double embryos, 412; fins, 458, 459, 461; head, 500; yolk-sac disease, 549; foetal membranes, 581; food, 581, 582; respiration, 583, 584; skull, 591 f.; twin embryos, 604, 605
 Emden, 484
 Emotions, 381
 Ems R., 483
 Enamel, 397, 399, 400, 401
Encheliophis, 572, 643; adult form, — see *Fierasfer*
Enchodontidæ, 641
 Encyclopedias, 494, 495
 End-organs, 526, 586
 Endocardium, 502
 Endolymph, 380
 Endoparasites, 545
 Endoskeleton, 457, 458, 587–590, 593
 Endothelium, 389, 390
 Engano I., 456
 Engelsberg, 568
 Engelstein, 567
 England, 468, 506, 516, 548, 576; fauna, 441, 442; fisheries, 462, 469, 471, 472, 473, 474, 481; markets, 468; museums, 518; palæontology, 531, 532, 533, 534, 535, 537, 539, 542; fishes introduced, 556, 557, 558,

- 559; pisciculture, 561, 565
 English Channel, 481
Engraulinæ, 626
Engraulis, 415, 493, 515, 525, 529, **626**; fisheries, 470; growth and age, 497; culture, 560, 568; reproductive organs, 609
Enneacanthus, 373, 499
 Enniskillen, 518
Entelurus, 577
 Enteroliths, 494
Entersphenus — see *Entosphenus*
 Entoblast — see Entoderm
 Entoderm, **412**, 515, 605
 "Entonnoirs segmentaires," 608
Entosphenus, 616
 Entozoa (parasites), 544, 545
 Environment — see Ecology
 Enzymes, 403
 Eocene fossil fishes, 538, 539
 Eosinophiles, 384
 Ependyma, 523
Ephippus, 513, 650
Epibdella (parasite), 545
 Epiblast — see Ectoderm
Epicyrthus, 378
 Epidemics — see Pathology
 Epidermis, 393, 399, 458, **509**, **510**, 586; parasites of, 544
Epigonichthys, 615
Epinephelus, 375, 498; taxonomy, 648
 Epinephrin, 598
 Epiphysis cerebri, 386, 387
 Epithelioma papulosum, 549
 Epithelium, 380, 502; cloacal, 365, 366; gastric, 365, 403; squamous, 365; intestinal, 366; retinal, 419; cysts, 543; parasites of, 548; notochordal, 588; cœlomic, 598
 Equilibrium, 501 — see also Static Sense
Eremophilus — see *Arges*
Ergasilidæ (parasites), 544
 Erie, Lake, 425, 476
Erisichthe — see *Protosphyraena*
 Eritrea, 422
 Erivan, 450
 Erlach, 569
 Erlaph See, 439
 Erne, Lough, 506
Errata, **354** f.
Erythrinæ, 634
Erythrinus, 364, 377, 583
 Erythrocytes, 383
 Esbo-Löfö, 470
 Escambia R., 425
 Escolar — see *Ruvettus*
 Eskdale, 533
 Esocidæ, 589, **641**, **642**
Esor, 364, 382, 385, 399, 403, 494, 509, 516, **641**, **642**; anatomy, 369; fishing, 371, 490; in aquaria, 375; auditory organs, 380, 501; parasites of, 404, 549; embryology, 410, 413, 415; growth and age, 497, **498**, **642**; habits, 499; hybrids, 507; nervous system, 524, 525; pectoral girdle, 550; culture, **562**, 565; voracity, 575; reproduction, 577; skull, 592, 593, 604; spinal cord, 596; suprarenals, 598; teratology, 603, 604; *Esor masquinongy*, 371, 498, 570, **642**
 "Essence d'orient," 465
 Esthonia, 450
 Étang de Thau, 445, 483
Etelis, 649
Etheostoma, 375, 392, 576
Etheostominae, 493, 590, **648**
 Ethmoid region, 591
Etroplus, 374
 Eubœa I., 541
Eucopepoda (parasites), 544
 Euganean Hills, 448
Eugnathidæ, 624
Eulachon — see *Thaleichthys*
Eulamia, 552
Euphorbia (poisonous plant), 489
Eupomotis, 373; introduction, 556; nests, 579; taxonomy, 648
Euprotomiscrus, 368
 Europe, 493, 505, 506, 508, 516, 517, 519, 543, 544, 576; angling, 372; aquaria, 372; fauna, 396, 405, **439-453**; fisheries, 466, 467, 469, 471, 472, 473, 474, **480-488**, 602; markets, 468; museums, 517-519; palæontology, 530, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542; fishes introduced, 556, 557, 558, 559; pisciculture, 562, 564, **565**; vernacular names, 600
 Eurre, 541
Eurycormus, 609
Eurypharynx, 369, 641
Eusthenopteron, 461, 551, **622**
 Eutin, 567
Eutropius, 378
 Euzet, 539
 Evois, 462, 470
Evolution, 385, 398, 399, **415** f., 501, 529
Evorthodus, 374
 Excretion, 551; excretory organs, 361, 606, 607
 Exhibition — see Collection
Exocætus, 380, 461, 550, **645**; ova and larvæ, 572; spawning, 577; skull, 594
 Exophthalmia, 547
 Exoskeleton, **399** f., 593
Exostoma, 637
 Exostosis, 547
 Expeditions — see Voyages
 Explosives, 488, 489
 Extractive bodies, 389
Eye, 388, 394, **418** f., 501, 514, 591, 592, 601; of cave fishes, 382; optic reflex, 382, 524; parietal eye, 386, 387; optic lobes, 387; crystalline lens, 388, **419**, 575, 603; retina, 388, **419**, 523; deep-sea fishes, 396; telescopic, 396; abyssal fishes, 418; iris, 419, 510, 601; optic chiasma, 525, 655; optic nerves, 525, 526; diseases and parasites of, 544, 547, 549; cornea, 547; orbitosphenoid, 592; abnormalities, 603; muscles, 603, 613; vision, 613, 614; of flatfishes, 655
 Fabriano, 541
 Face, 500
 "Fadenkörper," 510
 Fæces, 367, 548
 Faistenauer See, 440
 Falkenberg, 535
 Falkland Is., 434
 Fall-fish — see *Semotilus*
 Fanning Is., 456
 Farlow, 532
 Faroe Is., fauna, 444; fisheries, 482; plankton surveys, 572
 Fascia, 588
 Fasciculus communis, 388
 Fat, 388, 389, 465, 514, 551
 Faucigny, 566
 Fauker See, 439
Fauna, **420-457**; artesian well, 382, 406; cave, 382; deep-sea, 395 f.; distribution, 404 f.; abyssal, 405; lake, 405, 452; mountain, 405, 452; zoogeographical relations, 405; hot springs, 406; salt lakes, 406; salt wells, 447
 Fayûm, 538
 Fecundity, 576
 Feeding habits — see Food
 Feelers, 599
 "Felchen" — see *Coregonus*, European species
 Feldberg, 567
Felichthys, 580, 604
 Ferguson plunging buckets, 555
 Fernando Noronha I., 420, 433
 Fernando Po I., 422

- Ferrante Imperato, Mus., 518
 Fertility, 505, 506
 Fertilization, **410**, 595, 596;
 self-fertilization, 503;
 cross-fertilization, 505,
 582; artificial fertiliza-
 tion, 410, 555 — see also
 Spermatozoa
 Fertilizer, 465
 Fibrous tissues, 587, 588
 Fierasfer, 572, 586, 609,
 643; anatomy, 369; sym-
 biosis, 395; larvæ — see
 Encheliophis, 572, 643
 Fierasferidæ, 643
 Fighting fish — see *Betta*
 Figures — see Iconography
 Fiji Is., 456, 558; fishing,
 490
 Filaria (parasites), 546
 Filefishes — see Balistidæ
 Filter, 554
 Filum terminale, 596
 Fin-frills, 603
 Fin-rays, 458; taxonomic
 value, 599; effect of tem-
 perature on, 601; varia-
 tion, 610
 Fin spines, 401, 402, 417,
 457, 458, 580, 586; ich-
 thyodorulites, 459; use in
 locomotion, 512; poison-
 ous, 573; stridulation,
 594
 Fingerlings, 554, 564
 Finke R., 453
 Finkenwärder I., 462
 Finland, 506, 516, 554;
 fauna, 451; fisheries, 462,
 470, 471, 472, 473, 474,
 486, **487**; pisciculture,
 470, 562, **568**; museums,
 518; fishes introduced,
 556, 557, 559
 Finland, Gulf of, 450, 451
 Finmarken, 449
Fins, 391, 417, **457** f., 520;
 forming adhesive disk,
 362; coloration, 393; lat-
 eral fin-fold, 416, **417**;
 paired fins, 416, 417, 418,
 457, 459, **460**; azygos
 fins, 417; vertical fins,
 417, 582, 583; adipose
 fins, 458; "pre-anal" fin,
 459; relation to equilib-
 rium, 502; as contact
 organs, 510; locomotion
 by, 512; muscles, 521;
 parasites of, 543, 544;
 regeneration, 575; as in-
 tromittent organs, 582;
 respiratory functions,
 583; as tactile organs,
 599; abnormal, 603; as
 urinogenital organs, 606;
 — anal, **459**, 512, 586,
 587, 603, 606; caudal,
 391, **459**, 460, 512, 575,
 581, 584, 588, 601, **603**;
 dorsal, 362, **459**, 521,
 523, 599, 603; median,
 402, 416, 457, **459**, 512;
 pectoral, 412, 417 f.
 (primitive), 460, 461, 512,
 523, 587, 603; pelvic,
 362, 393, 460, 461, 578,
 584, 603
 Finspong, 568
 Fires, 489
 Fischereibuch Kaiser Maxi-
 milians I, 462
 "Fish-eaters," 465
 Fish farming, Scotland,
 565; France, 566; Italy,
 567
 Fish-measuring board, 463
 Fish scrap, 465
Fisheries, **462** f.; influence
 of environment, 405;
 Fisheries Dispute, 468;
 Fisheries Museum, Can-
 ada, 519; depletion by
 seals, 559; influence of
 climate, 602
 Fishermen, economic con-
 ditions and education,
 462; legislation, 467; fes-
 tivals, 605
 Fishery Board for Scotland,
 469, **482**
 "Fishhawk," **477**, 562, 563
 Fishing-frog — see *Lophius*
Fishing Methods, 371,
 463, **488**, **491**, 508; his-
 torical, 379, 462, 504, 505
 Fishways, 554, 569
Fistularia, 392, 572
 Fistulariidæ, 589
 Fitzroy R., 453
Fitzroyia, 376
 Flatfishes — see *Pleuronec-*
 tidæ
 "Fleckenkrankheit," 550
 Flesh, 389, 491; color, 388;
 parasites of, 404; poison-
 ous, 573, 574
 Fletcher Lake, 427
 Flies, artificial, 371, 381,
 488
 Flies as food, 555
 Flight — see Flying Fishes
 Flödevig, 561, 568
 Flood, 605
 Florence, 518
 Flores I., 455
 Florida, 392, 516, 601;
 fauna, 426, 427; fisheries,
 469, 473, **478**; palæon-
 tology, 542; pisciculture,
 562, 563, 569
 Florissant formation, 540
 Flounder — see *Pleuronec-*
 tes flesus
Flying Fishes, **491**, 645;
 in aquaria, 377, 378; fins,
 461; biblical refs., 605;
 fresh-water flying-fish —
 see **Pantodon**
 Flying Gurnard — see *Dac-*
 tylopterus
 Foetal membranes, 581
 Fohnsdorf, 541
 Folk-lore — see Mythology
 Folkstone, 537
 Follicular membranes, 528
 Fontanelles, 592
 Food fishes, 403, **465**, 469;
 of Arctic, 420; African,
 421; American, 424, 429;
 British Isles, 441; North
 Sea, 449, 462; herring,
 471; botargo, 472;
 salmon, 473; sardine,
 473, 474; caviar, 474;
 migrations, 515
Food of fishes, 362, 365,
 393, 403, **491-493**, 504,
 549, 555, 559, 564, 606;
 Pütter's theory, 551; food
 of embryos, 581
 Foramina, 590
 Fore-brain — see Telen-
 cephalon, 386
Foreign Bodies, **493**
 Forest Bed series, 542
Form of Fishes, **493**, **494**;
 asymmetry, 654
 Formosa I., 438
 Fornix conjunctivæ, 419
 Fort Benton, 428
 Fort Bidwell, 426
 Fort Riley, 427
 Fort Thomas, 426
 Fort Union, 536
 Fort Washington, 569
 Forth, Firth of, 443
 Fossil fishes, 362, 399, 491,
 504, 508, **529** f., 662-665;
 brain casts, 388; deep-
 sea, 395; dentition, 397,
 665; classification, 399,
 599; dermal skeleton,
 399; scales, 399, 401;
 food of, 492; plates, 508;
 museum specimens, 517-
 519; pectoral girdle, 550;
 spinal cord, 596; study
 methods, 601 — see also
 Palæontology, **529** f.
 Four-eyed fish — see *Ana-*
 bleps
 Fovea centralis, 419
 Fox Shark — see *Alopias*
 France, 463, 464, 493, 507,
 516, 528, 548, 549, 576,
 578; fauna, 405, 444-446;
 fisheries, 462, 467, 470,
 472, **473**, 474, **482**, **483**,
 484, 554; markets, 468;
 museums, 518; palæon-
 tology, 532, 533, 534,
 535, 536, 537, 539, 540,
 541, 542; pisciculture,
 554, 562, 563, 564, 565,
 566, 567; fishes intro-
 duced, 556, 557, 558, 559,
 561; fish-farming, 566;
 plankton surveys, 571,
 572; vernacular names,
 600
 Frankfort-a.-M., 540
 Freemantle, 453
 Freezing, effects of, 602
 French Guiana, 435

- Friedrichroda, 534
 Friedrichshafen, 467
 Friedrichshagen, 470
 Friendly Is., 457
 Frilled Shark — see *Chlamydoselachus*
 Frische Haff, 446
 Friuli, 539
 Froidenfontaine, 540
 Frontal gibbosity, 587
 Frontals, 592
 Froriep's ganglion, 522
 Fry, 549, 554, 556
 Fulton Market, 468
 Fumel, 536
 Funafuti I., 456
Fundulus, 412, 415, 643; in aquaria, 376; eggs, 381, 409; memory, 382; hearing, 501; hermaphroditism, 504; in fresh-water, 552; regeneration, 575; alleged viviparity, 582; confused with *Umbra*, 642
 Fundy, Bay of, 424, 516
 Fungi, 549, 550, 563
 Funicular nuclei, 388
 Furunculosis, 548, 549
 Fusaro, Lake, 448
 Fusiform cells, 597
 Fusiform type, 493
 Fyen I., 470

 Gabbro, 541
 Gabun, 422
 Gadidae, 397, **646**, **647**; distribution, 404, 405, 646; food of, 493; growth and age, 497; habits, 499, 646; hermaphroditism, 504; ova and larvæ, 572, 646; alleged viviparity, 582; osteology, 589; taxonomy, 646
Gadopsis, 364
Gadus, 366, 388, 391, 393, 418, 502, 511, 520, 527, **646**; anatomy, 369; embryology, 409, 411, 413, 415; nerves, 524, 525, 527; ova and larvæ, 572; spawning grounds, 572, 578, 646; skull, 592, 604; taxonomy, 646
Gadus aeglefinus, 409, 468, 469, 516, **646**; food of, 492, 493; growth, 496, 497; hermaphroditism, 504; destroying fishes, 559
Gadus esmarkii, 496, 646
Gadus merlangus, 409, 504, 603, **646**; food of, 493; growth, 496, 497, 646
Gadus morrhua, 389, 409, 516, **647**; "red cod," 404, 469; eye, 418, 419; culture, 464, 555, **561**, **568**; cod-liver oil, 466; fisheries, **470**, **471**, 475, 476, 477, 484, 485; codfish emblem, 471; food of, 492, **493**; gastroliths, 494; growth, 496, 497, 498; hermaphroditism, 504; marking experiments, 516; nerves, 526; breeding habits, 576, 577, 647; spermatozoa, 595; teratology, 603, 604
Gadus pollachius, 497, 576, **647**
Gadus pontassou, 647
 Gadushistone, 595
 Gaeta, Gulf of, 447
 Gaillon, 536
 Gairach, 541
 Galapagos Is., 434, 559
Galarinus, æstivation, 363; as whitebait, 474; migrations, 516, 552; skeleton, 589; taxonomy and distribution, 641
 Galaxiidae, 361, 404, **641**
Galeichthys, 580, 582
Galeocercus, 385, 618
Galeorhinus, 581
Galeus, 543, 581
 Galicia, fauna, 439, 440; fisheries, 480; palæontology, 531, 540, 541; fishes introduced, 557; pisciculture, 565
 Galilee, Sea of, 439, 480
 Gallaland, 421
 Gall-bladder, 391, 511, **512**; parasites of, 545, 549
 Galletto, 535
 Gallio, 538
 Galloway, 444
 Galvanotaxis, 381
 Gambia R., 422
 Gambusia, 643; in aquaria, 376; embryology, 415; introduction, 559; viviparity, 582
 Ganana R., 423
 Ganges R., 436, 466, 552
 Ganglia, 502, **522**, 525, 526, 547, 549, 596, 597, 598; parasites of, 547, 549
 "Ganglienleiste," 522
 Ganglion isthmi, 522
 Ganoidei, 361, 416, 588, 596, **621** f.; alimentary canal, 364, 365, 366; anatomy, 368; fossil forms, 368, 508, 612, **622**; auditory organs, 380; blood, 383; brain, 385, 386; circulation, 389, 390; taxonomy, 399, **622**; embryology, 410, 411, 412, 413, 414; eye, 418, 419; fins, 458, 460; food of, 492; size, 498; habits, 499; heart, 503; coloration, 510; lateral line system, 511; muscles, 520; nervous system, 522, 523, 524, 525; olfactory organs, 527; pancreas, 543; pectoral girdle, 550; pelvic girdle, 551; breeding habits, 576, 577; respiratory organs, 584, 585; thymus glands, 605; thyroid gland, 606; urogenital system, 609; vertebral column, 611; visceral skeleton, 612
 Ganoin, 397, 401
 Garda, Lake, 447, 485
 Gardner's Lake, 558
 Garfish — see *Belone*
 "Garland," trawling experiments, 482; plankton investigations, 571
Garmannia, 395
 Garonne R., 445
 Gar-pike — see *Lepidosteus*
 Garum, 365
 Gascony, Gulf of, 444
 Gascoyne, 533
 Gas disease, 547
 Gas glands, 363
 Gases, air bladder, 364; atmospheric, 406, 552, 553
 "Gaskohle," 534
 Gaspé, 531
 Gassino, 539
 Gassr Dachel, 536
 Gasterosteidae, 644
Gasterosteus, 381, 388, 394, 458, 586, 610, **644**; in aquaria, 375; embryology, 410, 415; food of, 492; size, 498; hermaphroditism, 504; overland progress, 513; olfactory organs, 527; ovum, 529; parasites of, 550; in salt water, 552; spawning, 577; nests, 578; skeleton, 589; skull, 592
Gasterotokeus, 606
 Gastric glands, 363, 365
 Gastric juice, 403
Gastroblecus, 380
Gastrodidymus, 603
Gastroliths, 494
Gastrolepecus, 377, 491, 589
Gastrostomus, 593, 609, **641**
 Gastrulation, 411, 412, 413
 Gatty Marine Labor., 469
 Gatun, 540
 Gebi I., 455
 "Gelbseuche der Rotaugen," 548
 Gempylidae, 590
 Gemünden, 532
General Works on Natural History, 494, 495
 Genetics, 409, 505, 586; biogenetic law, 416
 Geneva, 519
 Geneva, Lake, 515, 516, 548; fauna, 453; fisheries, 488; fishes introduced, 557, 558; pisciculture, 569
 Geneva, Lake, Wisconsin, 557
 Genito-urinary organs — see Urinogenital System

- Genoa, 467, 518
 Genoa, Gulf of, 448
Genypterus, 660
 Geography, 404 f., 420 f.
 Geology, 404, 416, **530** f.
Geophagus, in aquaria, 374;
 hybrid, 507; oral gesta-
 tion, 580; frontal gib-
 bosity, 587; taxonomy,
 651
 George, Lake, N. Y., 570
 George's Bank, — see St.
 George's Bank
 Georgia, 427, 478
Geotria, 368, 616
 Geotropism, 381
 Gephyrocercy, 459, 460
 Gera, 447, 534
 Gerace, 539
 Germ cells, 409
 Germ layers, 412, 599
 Germ ring, 412, 413
 Germany, 464, 493, 504,
 505, 506, 507, 508, 516,
 543, 549, 576; fauna, 446,
 447; fisheries, 467, 470,
472, 473, 474, **483**, **484**,
 554, 557; markets, 468;
 museums, 518; palæon-
 tology, 531, 532, 533,
 534, 535, 536, 537, 539,
 540, 541, 542; fishes in-
 troduced, 556, 557, 558,
 564; pisciculture, **561**,
 562, 563, 566, 567; ver-
 nacular names, 600
 Germinal disk, 410
 Gerridæ, 399, 650
 Gesse, 566
 Gestation, brood-pouch,
 578; oral, 579
 Giant ganglion cells, 596
Gibbonsia, 392
 Gibbosity, 587
 Giesen, 518
 Giesshübl, 541
 Giffoni, 535
Gigantichthys, 664
 Giglio I., 448
 Gila R., 425
 Gilbert Is., 456
 Gileppe, Lake, 480, 565
 Gill-arches — see Branchial
 arches
 Gill-cavities, 395, 546, 578
 Gill-clefts — see Visceral
 clefts, 613
 Gill-covers, 496, 584
 Gill-helix appendages, 585
 Gill-nets, 463
 Gill-rakers, 585, **613**
 Gillaroo trout, 629
 Gillion, 629
 Gills, 390, 392, 417, **585**;
 external gills, 417, 581,
 585; parasites of, 543,
 544, 545, 549, 550; dis-
 eases of, 549, 550; as
 respiratory organs, 583,
584; abnormal, 602
 Gilolo I., 455
 Ginanni, Mus., 518
Ginglymostoma, 528, 580,
618
Girardinus — see *Lebistes*
 Gironde R., 445
 Glacial marl, 542
 Glacial period, 405
Glanis — see *Parasilurus*
Glaridichthys, 369, 376
 Glasgow, 443
 Glatz, 537
 Globe Fishes — see Tetro-
 dontidæ
 Globulin, 528
 Glochidia (parasites), 544
 Glossopetræ, 398, 530
 Gloucester, Mass., 478, 561
 Glucosides, 553
 Glue, 465, 466
Glugea (parasite), 547
 Gmünden, 565
Gnathodentex, 650
 Gnathostomata, 367, 527,
 598
 Gobiesocidæ, 659
Gobiesox, 513, 609
 Gobiidæ, 362, 374, 414, 499,
 509, 519, 572, **657**
 Gobiiformes, 657
Gobio, 564, 635
 Gobioidæ, 590
Gobius, 402, 414, 415, 500,
 507, 529, 577, 657; in
 aquaria, 374, 378; as
 whitebait, 474; nests,
 579; urinogenital organs,
 609
 Goblet cells, 509, 510
 Goby — see Gobiidæ; blind
 Goby — see *Typhlogo-
 bius*, **382**, 509
 Goeldi Mus., Para, 519
 Görz and Gradiska, 440,
 537, 565
 Goethe-Oken theory, 591
 Goitre, 547
 Goktscha Lake, 450, 516
 Gold Coast, 422, 475
 Gold Orfe, 564
 "Golden Crown," 479
 Goldfish — see *Carassius*
 Golfe de la Napoule, 483
 Golgi, nerve cells of, 523
 Gonads, 503, 504, 603;
 gonaducts, 361; gona-
 ductomy, 555
 Gondokoro, 421
 Gonorhynchidæ, 594, 634
Gonostoma, 514, 572
Goodea, 512
 Goosefish, 465
 Goram I., 455
 Gorée, 423
 Gosport, 517
 Gothenburg, 467
 Gothland I., 531
 Gottorp Castle Mus., 518
 Gourami — see *Osphrome-
 nus*; Purring Gourami
 — see *Ctenops*
 Government Central Mus.,
 Madras, 517
 Gozo I., 448
 Graciosa I., 480
Grammicolepis, 369
 Grammistinae, 649
 "Grampus," 477
 Grand Banks, 475
 Grand Lake Stream, 562
 Grayling — see *Thymallus*
 Grays Thurrock, 542
 Great Belt, 462
 Great International Fish-
 eries Exhibition, 466, 467
 Great Lakes, fauna, 425;
 fisheries, 474, 476; pisci-
 culture, 557, 564, 569
 Great Yarmouth, 442
 Greece, ancient literature,
 462, 488, 504, 505, 514;
 fauna, 447; fisheries, 484;
 mythology, 521; palæon-
 tology, 541; vernacular
 names, 600
 Green Lake, 430
 Green River shales, 538
 Greenland, 425, 476, 531
 Greenland Shark — see
Læmargus
 Green's Creek, 542
 Gremaz, 566
 Gremsmühlen, 567
 Grenoble, 566
 Grilse, 629
 Grimsby, 481
 Grindle — see *Amia*
Gronias, 382
 Gronovii, Mus., 518
 Gronow Coll., 517
 "Grosse Maräne," 564
 Grotte de Thysville, 383
 Grottos, 379
 "Group-series," 496
 Grouper — see *Epinephelus*
Growth, 399, **496-498**;
 size, 395, 410, **496-498**,
 571, 601; age, 401, 496-
 498, 583, 586; growth-
 rings, 401, 402; scales,
 401; measurement, 496,
 601; marking experi-
 ments, 516; sexual matur-
 ity, 577
 Grunt — see *Hæmulon*
 Guadalquivir R., 452
 Guadeloupe, 431
 Guadiana R., 449
 Guam I., 456
 Guanajuato, 432
 Guanin, 464, **465**, 510, **511**,
 595; in retinal epithelium,
 419
 Guano, 465
 Guatemala, 431
 Guayaquil, 434
 Gudgeon — see *Gobio*
 Guiana, 491 — see also
 British, Dutch, and
 French Guiana
 Guide-books, 517
 Guildford, 539
 Guilds, 462, 483
 Guinea, fauna, 422; fish-
 eries, 475; palæontology,
 538

- Guitar fishes — see *Rhinobatidae*
 Gulf Stream, 602
 Gullane, 533
 Gunnel — see *Pholis*
 Gurnards — see *Triglidae*;
 Flying Gurnard — see *Dactylopterus*
Gustatory Organs, 388, 498, 525; taste, 599
Gymnallabes, 378
Gymnarchus, 361, 413; anatomy, 369; electric organs, 406, 407; embryology, 415; breeding habits, 576; nests, 578; respiration, 583, 585; skeleton, 589
Gymnetrus — see *Regalecus*
Gymnocranius, 650
Gymnodontes, 662
Gymnodontidae, 399, 500, 590
Gymnosarda, 399, 602; fishing for, 489; poisonous properties, 574; fisheries, 652
Gymnotidae, 369, 378, 407, 634
Gymnotini, 364
Gymnotus, 634; anatomy, 369; in aquaria, 378; electricity, 406, 407, 408; habits, 499; medical use, 514; reproduction, 579, 582
 Gypsum of Montmartre, 539
Gyrocotyle (parasite), 546
Gyrodactyliasis, 545
Gyrodactylus (parasite), 545
Gyrodus, 623

 Haarlem, 518
 Habitat — see Ecology
Habits, 498 f., memory, 381; use of electricity, 408; feeding, 461, 491-493, 515, 559; locomotion, 512, 513; migrations, 515, 516; parasitic, 546; predatory, 574, 575; breeding, 575-582; methods of studying, 601
 Haddock — see *Gadus aeglefinus*
Hadropterus — see *Alvordius*, 375
 Haegadalen, 470, 561
 Hæmal arches, 458, 585, 591, 611
 Hæmatology — see Blood
 Hæmoflagellates (parasites), 549
 Hæmogregarina (parasites), 548
 Hæmosporidia (parasites), 548
 Hæmulidae — see *Pristipomatidae*
Hæmulon, 381; taxonomy, 650
 Häring, 540
 Hag-fishes — see *Myxinoideis*
 Hague, The, 467, 468
 Haguineau, 541
 Hainan I., 436
 Hainaut, 537
 Hair, 397
 Hair-tail — see *Trichiurus*
 Haiti, 431
 Hake — see *Merluccius*
 Halberstadt, 535
 "Haleyon," 477, 562, 563
 Half-beak — see *Hemirhamphus*
 Halibut — see *Hippoglossus*
 Halieutics, 370, 371
 Halifax, 424, 425, 468
 Halle, 518, 536
 Haller's commissure, 388
 Hallwyler See, 453
 Halosauridae, 643
 Hamburg, 446
 Hamman - Meskhoutine, 421
 Hammerhead Shark — see *Sphyrna*
 Hamstead, 534
 Handbooks, 495
 Hanka Lake, 438
Haplochilus, 382, 392, 578; in aquaria, 376; breeding habits, 576, 577
Haplochitonidae, 641
Haplochromis, 374
Haplomi, 499, 588, 641-643; anatomy, 369; in aquaria, 375; embryology, 415; ova and larvae, 572; breeding habits, 576, 577; skeleton, 589; skull, 593; taxonomy, 641
Haplonotus, 650
 Haplosporidia (parasites), 549
Haplostethus, 590
 Harding sandstone, 530
 Haresfield Beacon, 535
Harpagifer, 659
Harriotta, 621
 Haruka I., 455
 Harz Mts., 532
 Haslar Hospital Mus., 517
 Hassendorf-in-Stade, 541
 Hatcheries, 565, 568, 569, 570
 Hatching — see Pisciculture
 Havana, 468
 Haversian system, 588
 Havre, 467
 Havre de Grace, 569
 Hawaiian Is., fauna, 397, 454; fisheries, 488; fishes introduced, 556, 559; pisciculture, 562, 570
 Hawkes Bay, 457
 Hawkesbury series, 536
 Hawthorn blossoms, odor of, 552
 Hazen, 542
Head, 500, 501; circulation in, 390, 391; mesoderm, 412, 515; taste buds, 498; tubercles, 510; ampullæ of Lorenzini, 511; attachment of eggs to, 578; frontal gibbosity, 587; teratology, 603, 604
 Head-kidney — see *Pronephros*
Hearing, 501, 502, 527, 591, 604; organs of, 379 f., 396, 525, 549
Heart, 384, 390, 391, 392, 502, 503, 522, 596, 601; fatty degeneration, 547; parasites of, 549; physiology, 552, 553; rhythm, 584
 Heat, effects of, 602
 Hebrew literature, 504
 Hebrides Is., 442
 Heersian stage, 539
 Heiningen, 536
 Helgoland, 446, 470
Helicoprion, 618
 Helmand R., 435
 Helmets of Diodon skin, 464
Helmichthys, 369
 Helminthology, 544, 545
 Helmstedt, 539, 540
Helodus, 618
 Hemibranchii, 550, 589, 644
Hemichromis, 374, 414, 587
Hemigrammus, 377
Hemiramphus, 499, 572, 592, 645; anatomy, 370; in aquaria, 379
Hemirhynchus, 652
 Hemiscylliinae, 618
 Hemitriptidae, 590
 Hemocytometry, 383
 Hemoglobinometry, 383
 Hemolysis, 384, 573
Henneguya (parasite), 550
 Hepatic portal veins, 391
Heptanchus — see *Notidanus*
Heptatrema, 389
Heptanchias — see *Notidanus*
 Heraldry, 521
 Heredity, 505
Hermaphroditism, 503, 504, 607
 Hernád R., 440
 Hernals, 541
Heros, 414, 507, 576, 651; in aquaria, 374
 Herring — see *Clupea harengus*
 Herring seine-net, 463
 Herzegovina, 440, 480
Heterandria, 376
Heterobranchus, 585
 Heterocercy, 459, 460
Heterocotylea (parasites), 545
Heterodontidae, 618
Heterodontus, 385, 398, 400, 414, 418, 528, 608, 618
Heterogramma, 374, 577; taxonomy, 651

- Heteromi, 369, 572; taxonomy, 643
 Heteromorphosis, 575
Heterophthalmus, 514
Heteropleuron, 610
 Heterosomata, 653 — see also *Pleuronectidæ*
Heterostichus, 579
 Heterostraci, 401, 663
Heterotis, 369, 585; nests, 579
 Hexagrammidæ, 658
Hexanchus — see *Notidanus*
Hibernation, 504, 602
 Hieroglyphics, 521
Hieroptera, 620
 Hildesheim, 535, 536
 Hillsborough, 532
 Himalaya Mts., 435
Himantolophus, 661
 "Hinterzellen," 596
Hippocampus, 369, 383, 384, 395, 402, 415, 504, **644**; in aquaria, 375; tail as prehensile organ, 459; trunk muscles, 521; brood-pouch incubation, 578
Hippoglossoides, 656
Hippoglossus, **653**; fisheries, 484; food of, 492; size, 498; habits, 499; muscles, 520; eggs and larvæ, 654
 "Hirondelle," 396
Histioccephalus, 658
Histiophoridae, 551, **652**
Histiophorus, 649, **652**
 Histones, 595
Historical Matter, 504, **505**, 507, 508; fisheries, 462; palæontology, 530; pisciculture, 553
 Hogland I., 451
 Hokkaido I., 438
Holacanthus, 650
Holaspis, 663
 Holland — see Netherlands
 Holoblastic cleavage, 411
Holocentridæ, 590
Holocentrum, 647
Holocephali, **621**; anatomy, 368; dentition, 398; denticles, 400; embryology, 414; fins, 458; nerves, 526; egg cases, 528; skull, 593; urinogenital system, 608; vertebral column, 611
Holonema, 664
 Holonephros, 606, 607
Holoptychidæ, 622
Holostei, 401, **623**, 624; dentition, 398; fins, 461; skeleton, 589; skull, 593; urinogenital system, 609; vertebral column, 612
Holostomum (parasite), 545
 Holton's hatching apparatus, 554
 Holzmaden, 536
 "Homomor," 490
 Homocercy, 460
Homosteus, 664
 Homs, Lake, 439
 Honduras, 489
 Hongkong, 436
 Hood R., 569
 Hook, 489
 Hopkins Seaside Laboratory, 469
Hoplichthyidæ, 658
Hoplognathidæ, 649
Hoplostethus, 593
 Horned Dace — see *Notropis*
 Horned Pout — see *Ameiurus*
 "Hornfäden," 458
 Hot springs, 406
 Hougue, Bay of, 572
 Howietoun hatchery, 507, 565
 Hudson Bay, 424
 Hudson R., 597; fauna, 429; fisheries, 474, 478; pisciculture, 556, 563
 Hué R., 436
 Hülsberg, 567
 Hünigen, 507, 567
 Hütteldorf, 531
 Hungary, fauna, 440; fisheries, 480; palæontology, 534; bass introduced, 556 — see also Austria-Hungary
 Hurricanes, 516
 Husbandry, 371
 "Huxley," 571
Hyæna, 505
Hybodus, 612, 618
Hybrids and Hybridization, 399, 409, **505-507**
Hydrocœle embryonalis, 549
Hydrocynus, 377
Hydrocyon, 399, 592
Hydrocyoninae, 634
Hydrolagus, 401
 Hydrolysis, 595
 Hydrostatic functions, 364
 Hymen, 608
Hyodontidæ, 361, 594
 Hyoid arches — see Visceral Skeleton
 Hyomandibular gill cleft, 584
 Hyostylic skull, 592
 Hyperoarti, 616 — see also *Petromyzontes*
Hyperopisus, 362, 415, 579
 Hyperostosis, 547
 Hyperotreti, 615 — see also *Myxinoides*
 Hyperplasia, 597
 Hypertrophy, 599, 602, 603
Hypnos, 366
 Hypobranchial groove, 365
 Hypochord, 390, 611
Hypomesus, 633
Hypophthalmichthys, 585
Hypophthalmus, 380, 594
 Hypophysis cerebri, 387
Hypostomus, 369
 Hypoxanthine, 595
 Ice fishing, 488
 Iceland, fauna, 447; fisheries, 471, 472, **484**; marking experiments, 516; pisciculture, 567; vernacular names, 600
 Ichthidin, 528
 Ichthin, 528
 Ichthyepidion, 388, 402
Ichthyodectes, 626
Ichthyodorulites, 459
Ichthyology, 507, 508
Ichthyomyzon, 385
Ichthyonema (parasite), 546
Ichthyopatolites, 513
Ichthyophagi, 465
Ichthyophobia, 521
Ichthyophthiriasis, 550
Ichthyophthirius (parasite), 550
Ichthyopsida, 365
Ichthyopterygia, 416 f.
Ichthyosporidium (parasite), 549
Ichthyotænia (parasite), 546
Ichthyotomi, 458, 616
Icichthys, 646
Iconography, 508
Icosteus, 511, 646
Icostidæ, 646
Ictalurus, 415, 573, 637
Ictiobus, 576
 Idaho, fauna, 427; palæontology, 532, 534, 542
Idus, 385, 404, 559
Iguanodectes, 377
 Île de France — see Mauritius I., 437, 574
 Ilford, 542
 Iller R., 446
 Illhäusern, 483
 Illinois, 576; fauna, 427; fisheries, 478; palæontology, 531, 532, 533, 542
 Illustrations — see Iconography
 Ilmen, Lake, 450
 Ilminster, 535
 Imperato, Mus., 518
 Impregnation, 555, 595; artificial, 410, 555
 Incubation, 578, 579
 Incus, 380
 Index Zoologicus, 600
 India, 363, 404, 500, 516, 580, 583, 584, 605; fishing, 372, 489; fauna, 436, 437; fisheries, 467, **479**, 559; iconography, 508; museums, 517; palæontology, 533, 534, 535, 537, 539, 542; fishes introduced, 558, 559; pisciculture, 564
 Indian Ocean, expeditions, 396; fauna, 396, 437, 582; fisheries, 475, 478
 Indian R., 426

- Indian Territory, 427
 Indiana, 516; fauna, 427; palæontology, 531, 532; pisciculture, 569
 Indians (North American), fishing methods, 489, 491; vernacular names, 600
 Indo-Australian Archip., fauna, 454, 455, 456, 580; fishing methods, 488, 489
 Indo-China, French, 436
 Indo-Pacific Basin, 405
 Induction current, 366
 Inflation, 500
 Infundibulum, 387
 Infusoria (parasites), 550
 Ingoda R., 438
 Iniomi, 590, 625
 Innervation — see organ affected
 Innominate arteries, 390
 Insects as food, 555 — see also Mosquito destruction
 Instruction, 462
Integument, 361, 388, 401, 418, **508-511**, 547; color, 393; economic uses, 402; skin-folds, 459; sensory organs in, 498; as equilibrium organ, 502; guanin, 511; metameric structure, 515; end-organs in, 526; parasites of, 543, 545, 549, 550; diseases of, 547, **549, 550**; regeneration, 575; respiratory function, 584; teratology, 602
 Intelligence, 381, 382
 Inter-brain, 386
 Interbranchials, 521
 Intercellular substance, 587
 Internat. Comm. Investig. Sea, 463
 Internat. Fishery Congresses, 463
 Interrenal bodies, 597 f.
 Intestine, 365, **366**, 388, **390, 391**; spiral valve, **366, 367**, 390, 391, 603; pigment cells, 393; digestive function, 403; glands, 403; length, 491; epithelium, 510; diseases and parasites, 546, 547, 549; respiratory functions, 583; abnormalities, 603
 Intracellular fibrils, 523
 Intracortical fibers, 523
 Introduction, 474, **555-559**, 564, 569, 570; of eel, 561, 570
 Intromittent organs, **580**, 582
 Invagination, 410
 Investigations, deep-sea, 395 f.; North Sea, 449; fisheries, 462 f.; Plymouth Biol. Lab., 469; Irish Sea, 481; Fishery Board Scotland, 482; plankton, 571; methods, 600, 601 — see also Voyages
 Iodine, 606
 Iowa, 427, 531, 532, 569
Ipnops, 514
 Iquitos, 435
 Ireland, 506, 516, 518; fauna, 442, 443; fisheries, 471, 473, 481; palæontology, 533, 535; pisciculture, 565
 Iris, 419
 Irish Sea, 443, 481, 571
 Irkutsk, 438
 Irrawaddy R., 436
 Irrawaddy series, 542
 Isinglass, 466
Isistius, 385, 513
 Islands — see Oceanica, 453
 Islands of Langerhans, 543
 Islay, tailless trout, 603
 Isle Royale, Michigan, 428
 Isocercy, 459, 460
 Isocreatinine, 389
 Isola Pianosa, 541
 Isonzo R., 440
 Isopoda (parasites), 544
 Isospondyli, 625
 Issik-Kul, Lake, 438
 Istria, 440, 480, 537, 541
 Italy, 394, 484, 493, 508, 516, 548; palæontology, 399, 535, 536, 538, 539, 540, 542; fauna, 406, 447, 448; fisheries, 467, 470, 474, **484**, 485; markets, 468; museums, 518; diseases among Italian fishes, 543, 544, 545, 546; Italian lakes, 545, 546, 556; fishes introduced, 556, 557, 558; fish farming, **567**; pisciculture, 567; vernacular names, 600
 Itatiaya, 434
 Ivory Coast, 422
 Jacksonville, 427
 Jaffna I., 435
 Jalsajärvi, Lake, 451
 Jamaica, 431, 479, 543
 "James Fletcher," 469
 Janina, Lake of, 453
 Jan Mayen I., 420
 Japan, 368, 508, 521, 574; fauna, 397, 437; fisheries, 467, 469, 479, 480; fishing methods, 488, 490; museums, 517, 519; palæontology, 537, 542; fishes introduced, 557, 558; pisciculture, 564; vernacular names, 600
 Jaragua, 434
 Java, fauna, 455; fisheries, 488; palæontology, 542; pisciculture, 570; vernacular names, 600
 Jaws, **592**; dentition, 398; muscles, 520; abnormal, 604; origin, 613
 Jena, 535
Jenynsia, 376, 643
 Jew-fish — see *Stereolepis*
 Jews, 504
 Jhering, 438
Jobertina, 377
 Joggins Mines, 532
 John Dory, — see *Zeus*
 Johnston I., 456
 Johore, 438
 Jonah and whale, 605
 Jordan R., 580
Jordanella, 376, 582
 Jovellanos, Instituto de, 519
 Juan Fernandez Is., 435
 Judith R. Beds, 536
 Jugulares, 369, 414, 499, 572, **659-662**
Julis, 587
 Jurassic fossil fishes, 398, 528, 535, 536
 Kadiak I., 424
 Kaiser Wilhelm-Canal, 484, 577
 Kalaa-Dyerda, 540
 Kalla Lake, 451
 Kaltenleutgeben, 537
 Kama R., 451
 Kamchatka, 438, 439
 Kamerun, fauna, 422; fisheries, 475; palæontology, 536, 538
 Kamish Samara Lakes, 438
 Kamloops Lake, 424
 Kansas, fauna, 427; fisheries, 478; palæontology, 532, 533, 536; pisciculture, 569
 Kara Sea, 420
 Karachi, 436
 Karelian coast, 450
 Karlstad, 467
 Karroo Beds, 534
 Kars, 450
 Kasai R., 422
 Kashmir, 436, 534
 Kassel, 484
 Kastrup, 462
 Katabolism, 551
 Katanga, 422
 Kazan, 451, 518
 Keeling Is., 437
 Kei Is., 455
 Keitele Lake, 451
 Kelheim, 535, 536
 Kelpfish — see *Heterostichus*
 Kenderlyk R., 535
 Kennebec R., 563
 Kent Is., 454
 Kentucky, 427, 532
 Kenya, 421
 Kerguelen I., 420
 Kermadec Is., 457
 Kern R., 426, 493
Kessleria, 623 — see also *Scaphirhynchus*
 Keuper formation, 534

- Key West, 427
 Khunmu, 534
 Kidney, 601, **606-610**; renal arteries and veins, 384, 391, 598, 606, 607; secretions, 389, 502, 578; diseases and parasites, 547, 548, 608; supra-renal organs, 597 f.; mesonephros, metanephros, opisthonephros, pronephros, 598, 599, 606, **607**, 608, 609; functions, 606 f.; Wolffian duct, 606, **607**; Malpighian body, 607, 608
 Kiel, 470
 Kilimanjaro, 421
 Killala Bay, 442
 Killarney Lakes, 443
 King R., 453
 King George's Sound, 453
 Kingani R., 421
 King's I., 456
 Kircher Coll., 518
 Kis Küküllö R., 440
 Kitchenmiddens, 444
 Kite fishing, 489
 Kiusiu I., 438
 Kivu, Lake, 422
 Klamath Lake, 429
 Klamath R., 426
 Klein-Neudorf, 534
 Klöntaler See, 453
 Klupeovin, 528
 Kneridæ, 642
 Knoydart formation, 531
 Koblenz, 447
 Königssee, 446
 Kokos I., 456
 "Kolben," 509, 510
 Kolguf I., 450
 Kolomna, 533
 Kolyma R., 438
 Komadugu R., 421
 Kondué, 422
 Kongo, fauna, 421, 422; fisheries, 475; museum exhibit, 517; palæontology, 534, 538
 Korea, 438
 Korpo I., 451
 Koso-gol, Lake, 436
 Kossel, 595
 Krakowiza, 540
 Krasno-ufimsk, 534
 "Krebspest," 548
 Krefftius, 576
 Kreuznach, 447
 Kristiania, 531
 Krohnus, 646; adult form — see *Macrurus*
 Kuban R., 450
 Kubekowa, 534
Kuhlia, 648
 Kupffer's cells, 390
 Kupffer's vesicle, 413
 Kur R., 450
 Kura R., 548
 Kurdistan, 439
 Kurile Is., 438
 Kurisches Haff, 446
 Kurtidæ, 657
 Kurtiformes, 369, 657
Kurtus, 369, 578, 590; taxonomy, 657
 Kusomen, 568
 "Kuvalehti," 468
 Laacher See, 447
Labeo, 635
 Labial cartilage, 613
 Labrador, 424, 475
Labrax, 499, 576, 609, **648**, 649; spawning, 577; skull, 593; "Mopskopf," 604
Labrichthys, 651
 Labridæ, 399, 414, 420, 576, **651**
Labrosomus, 659
Labrus, 397, 550, 651; coloration, 393, 394; fossil, 399; nests, 578
 Labyrinth — see Membranous labyrinth
 Labyrinthici, 375, 576, 585
 Labyrinthiform organs, 382, 583, **585**
 Lac du Bourget, 445
 Laccadive Is., 437
 Lactones (fish poisons), 489
 Ladders, 554, 565
 Ladoga, Lake, 450
 Ladrone Is., 456
 Lady-fish — see *Albula*
 Laekenian stage, 539
Læmargus, 366, 368, 545, 620; luminous organs, 514; oviparity, 580; skull, 593; visceral skeleton, 612, 613; occurrence, 620
 Lagena, 380
Lagodon, 650
 Laguna Beach, 426
 Lake of the Woods, 428
 Lakwitz, 567
 Lambay I., 443
 Lamellæ, 584, 585
 Lameta Beds, 539
Lamna, 383, 386, 398; viviparity, 581; respiratory organs, 584; natural history and occurrence, 619
 Lamnidæ, 619
 La Mocha I., 434
Lampetra, 410, 503, 546, 616; spawning, 577; nests, 579; occurrence, 616
 Lamprey Eels — see *Petromyzontidæ*
 Lamprididæ, 590; taxonomy, 644
Lampris, 589, **644**
Lamprolaxus, 514
 Lancashire Coal Measures, 533
 Lancashire & Western Sea Fisheries Comm., 469
 Lance (fishing), 490
 Lancelets — see *Cephalochordata*
 Lancetfish — see *Teuthis*
 Landana, 538
 Landenian stage, 539
 Landskrona, 452
 Langerhans, Islands of, 543
 Laos, 436
 Lapland, fauna, 450; fisheries, 473, **487**; pisciculture, 568
 La Rochelle, 536
 Larvæ, 387, 409; food of, 413; metamorphosis, 571; pelagic, 571, 572 — see also Embryology, 408 f.
 Larynx, 364
 Lateral fold hypothesis, 416 f.
Lateral Line System, 382, 402, **511**, 586, 604; as organ of equilibrium, 502
 "Lateralstränge," 596
 Latero-sensory canals, 592
 Latin nomenclature, 600
 La Tola, 434
Latrunculus, 657
 Launce — see *Ammodytes*
 Lawrence, 427
 Laws — see Legislation
 Lea R., 441, 442
 Leaping habits, 513
 Leather, 402
 Leather-Jacket — see *Balistes*
 Leba See, 446
 Lebach, 534
Lebias, 369, 394, 410, 411, **643**; in aquaria, 376; reproduction, 529; respiratory organs, 585
Lebiasina, 377, 492
Lebistes, in aquaria, 376; as mosquito destroyer, 404; sex, 409, 586; breeding experiments and habits, 505, 577, 582; introduction, 559; double monstrosities, 604; taxonomy, 643
 Ledbury, 532
 "Lederhaut," 509, 510
 Leeward Is., 431
Lefroyia — see *Fierasfer*
 Legends — see Mythology
 Legislation, 462 f.
Leiognathus, 590
 Leithakalk, 541
 Léman, Lac — see Geneva, Lake
 Lemberg, 541
 Lemon Dab — see *Pleuronectes microcephalus*
 Lena R., 438
 Length — see Growth
Lentipes, 657
Lentospora (parasite), 547
 Lenzkirch, 533
 Léognan, 541
Lepadogaster, 375, 510, 511, 522, 587, **659**; adhesive disk, 362; embryology, 414; ova and larvæ, 529, 572; nests, 579; pronephros, 609
Lepidocephalichthys, 378

- Lepidoleprus*, 380
Lepidopidae, 590
Lepidopus, 499, 571, **652**
Lepidorthosis contagiosa, 548
Lepidosiren, 362, 363, 366, 527, **625**; morphology, 368; in aquaria, 373; blood, 383, 384; circulation, 389; embryology, 411, 414; fins, 460, 461, 603; heart, 502; nerves, 520, 523, 524; breeding habits, 576, 579; respiration, 584, 585; skull, 593; urinogenital system, 595, 606, 608; thymus glands, 605; visceral skeleton, 612
Lepidosirenidae, 398, **625**
Lepidosteidae, 624
Lepidosteoidei, 623 — see *Holostei*
Lepidosteus, 362, 397, 398, 460, 498, 511, 543, **624**; air-bladder, 364; anatomy, 368; in aquaria, 373; brain, 385, 388; circulatory system, 389, 390, 391; commensalism, 394; dermal skeleton, 401, 402; embryology, 409, 410, 411, 412, 414; food of, 492; habits, 499; nerves, 525, 526; voracity, 559, 575; breeding habits, 576, 577; respiration, 582, 583, 584, 585; skull, 593; reproductive organs, 609; vertebral column, 612
Lepidotrichia, 458
Lepidotus, 623
Lepomis, 507, 516; in aquaria, 373; introduced in France, 556; taxonomy, 648
Leporinus, 377
Leprosy, 403
Leptocardii, 615 — see also *Cephalochordata*
Leptocephali, 381, 389, **638**, **639**; coloration, 393; food of, 493; suprarenals, 598; adult forms — see *Anguilla* and *Conger*
Leptoscopidae, 659
Lepturidae — see *Trichiuridae*
Lernæa (parasite), 544
Lernæenicus (parasite), 544
Lernæidae (parasites), 544
Lernæopoda (parasite), 544
Lernæopodidae (parasites), 544
Lesina I., 537
Lethrinus, 650
Leucaspius, 378, 506, 576, 587, 635
Leucicorus, 385
Leuciscus, 369, 385, 393, 404, 501, 509, 523, 559, 603, 635, **636**; angling for, 371; in aquaria, 378; hybrids of, 505, 506; parasites of, 549, 550; culture, 564; breeding habits, 576; variation, 610, 636
Leucocytes, 384
Leucopsarion, 380
Lexicons, 494, 495
Leyden, 518
Leydig's duct, 606, **607**
Leydig's gland, 608
Lhasa, 436
Liao-ho R., 436
Lias, 535
Liberia, 422
Libyan Desert, 536
Licata, 541
Ligamentum annulare, 419
Ligamentum denticulatum, 612
Ligamentum longitudinale ventrale, 390
Light, (effect on fishes), 393, 396, 419, 420, 489, 516, 563
Light perception, 382, 596
Light production — see *Luminosity*
Ligula (parasite), 545
Ligulosis, 545
Limbs — see *Fins*
Limeray, 537
Limestone, Armagh, 533; productus, 533; lithographic, 536
Limewater preserving fish, 468
Limfjord, 565
Limhamn, 538
Limia, 376
Limoges, 566
Limulus eggs as food, 492
Lindi R., 422, 536, 540
Lindnerberg, 536
Line fishing, 489
Ling — see *Molva*
Linnæan Coll., Brit. Mus., 517; Upsala Mus., 519; nomenclature, 600
Linth R., 453
Linton Coal Measures, 532
Liocassis, 637
Liparididae, 658
Liparis, 410, 496, 499, **658**; adhesive disk, 362; skull, 593
Liparops, 658
Lipase, 403
Lippe R., 483
Lips, 365, 599
Lisbon, 518
Lismore, 565
Lithographic stone, 536
Little Cumbrae I., 443
Little Spokane R., 479
Live-boxes, 463
Liver, 388, 390, 403, 493, **511**, **512**, 574; bile, 388, **403**, **512**, 547, 595; parasites of, 548, 549
Liverpool, 466, 469, 517
Liverpool Bay, 442
Livonia, 450, 532
Loach — see *Cobitis*
Loanda, 538
Lobi inferiores, 387
Lobotidae, 648
Lobus electricus, 407
Loch Bad-a-Luacradh, 443
Loch Fyne, 443
Loch Ken, 498
Loch Leven, 507, 629
Loch Lomond, 444
Loch-na-Maorachan, 443, 603
Loch Ryan, 444
Locomotion, **512**, **513**; overland, 461; flight, 491; respiration as factor, 583; study methods, 601
Locusts as food, 605
Lodève, 534
Lofoten Is., 485, **561**
Loire R., 445, 483, 516
Lombardy, 448, 535, 538
Lombok I., 456
London, 466, 467, 468, 481, 517, 602
London Basin, 539
Long Island, 429
Longevity, 496, **497**, 498
Lonzée, 537
"Lookout," 477, 562, 563
Lophiidae, 661
Lophius, 391, 394, 461, 498, 509, 511, 547, **661**; anatomy, 370, brain, 385, 387; embryology, 409, 415; nervous system, 522, 523, 524, 525; egg rafts, 571; voracity, 575; reproduction, 577, 609; skeleton, 590; skull, 594; spinal cord, 596; angling apparatus, 661
Lophobranchii, **644**; air-bladder, 363; circulation, 391; dermal skeleton, 402; embryology, 415; heart, 502; brood-pouch incubation, 578; skeleton, 589; skull, 594; suprarenals, 598; urinogenital system, 609; taxonomy, 644
Lopholatilus, 389, 590, **649**
Lophotes, 661
Lophotidae, 590; occurrence, 661
Lorca, 541
Lord Howe I., 454
Lorenzini, ampullæ of, 511
Loricaria, 579, 594
Loricariidae, 369, 399, 594, **637**; in aquaria, 378
Loricati, 389, 593, 647
Lorraine, 446, 535
Lota, 369, 404, 507, 511, **647**; in aquaria, 375; circulatory system, 389, 390, 391; size, 498; hermaphroditism, 504; nerves, 523, 526; reproduction,

- 529, 577, 595; introduction in Switzerland, 558; skull, 594
 Lotahistone, 595
Lotella, 369, 380
 Lough Erne, 506
 Lough Neagh, 443
 Louisiana, 427, 478, 557
 Louisiana Purchase Exposition, 466
 Louisville, 427
 Low Archip., 456
 Lower California, 432
 Lowestoft market, 468
 Lozère, 536
 Lualaba, 534
Lucania, 376
Lucerna, 505
 Lucerne, Lake, 453, 569
Lucifuga, 382, 582, 609
Luciocephalus, 580, 582
Lucioperca — see *Stizostedion*
Luciotrutta, 576
Lucius, 575
 Ludlow series, 531
 Lüneburg, 535, 541
 Lüttringhausen, 567
 Lumezzane, 535
Luminosity and Phosphorescence, 396, **513**, **514**; deep-sea fishes, 381; relation to respiration, 583
 Lugano, Lake, 453, 506, 516
 Luleä, 452
 Luluabourg, 422
 Luminous fishes — see **Luminosity**
Lumpenus, 572, 604, **659**
 Lumpfish — see *Cyclopterus*
 Lung-fishes — see **Dipnoi**
 Lungs, 363, 364
 Lunzer See, 439
 Lures, 488, 661
 Lusatia — see **Niederlausitz**
 Lussin I., 440, 480
 Lussin-Piccolo, 468
 Lutjaninæ, 590, **649**
Lutjanus, 371, **649**; fisheries, 473
 Luvaridæ, 653
Luvarus, 366, 369, 385, 418, 520, 590, **653**
 Luxembourg, 448, 517, 565
Lycodes, 660
 Lycodinæ, 660
 Lyme Regis, 535
 Lymphatic system, 384, 389, **391**, 392
Lymphosporidium truttæ, 549
 Lyomeri, 594
 Maastricht, 538, 548
 Mackerel — see *Scomber*
 Mackerel Sharks — see **Lamnidae**, 619
Macquaria, 570
Macquarie R., 454
Macraspis (parasite), 545
Macrias, 395
Macrodon, 377
Macrones, 378
Macropetalichthys, 664
Macrophthalmia, 616
 Macropodes, 374, 375, 577
Macropodus — see *Polyacanthus*
 Macrorhamphosidæ, 589
Macrorhamposus — see *Centriscus*
 Macruridæ, 366, 500, 511, 524; ova and larvæ, 572; palæontology, 646; taxonomy, 646
 Macruriform type, 493
 Macula neglecta, 380
Macrurus, 594, 646; larval form — see *Krohnii*
 Maculæ acusticæ, 380
 Madagascar I., fauna, 422; palæontology, 532, 533, 535, 536, 540; carp introduced, 556; pisciculture, 564
 Madeira Is., fauna, 422; fisheries, 475; museums, 518; vernacular names, 600
 Madeira R., 433, 489
 Madras, 436, 517, 543; palæontology, 537
 Madrid, 519
 Madü-See, 446, 447
 Madura I., 456
 Mälaren, Lake, 452
Mæna, 650
 Märkisches Provinzial Mus., 518
 Maestricht — see **Maastricht**
 Magdalena R., 434
 Magdeburg, 447, 533, 540
 Magellan Straits, 433
 Maggiore, Lake, 448, 567
 Magnetic sense, 586
 "Mahaseer" — see *Barbus*
 "Maifisch" — see *Clupea alosa*
 Maikantschatschai Mts., 535
 Mail-cheeked fishes — see **Loricati**
 Mailed Gurnard — see *Trigla*
 Main R., 446, 483, 567
 Maine, fauna, 427; fisheries, 473, 474, **478**; pisciculture, 557, 562, 563, **569**
 Maintenon, 566
 Mainz, 446
 Mainzer Becken, 540
 Makatea, 456
Malacanthus, 622; adult form — see *Orthogoriscus*
 Malacca, 438
 Malacopterygii, 364, 588, **625-634**; anatomy, 369; in aquaria, 378, 379; embryology, 415; food, 493; habits, 499; ova and larvæ, 572; breeding habits, 576, 577; skeleton, 589; skull, 594
 Malacocotylea (parasites), 545
 Malaria eradication, 404
 Malay Penin., 438, 513, 521, 564
 Maldive Is., 437
 Maledi, 534
 Malleus, 380
Mallotus, 415, 499, 577, 587, **633**
 Malopterurinae, 637
Malopterurus, **637**; anatomy, 369, 370; in aquaria, 378; electrical organs, 407; skin, 509; lateral line, 511; muscles, 520; parasites, 543; reproduction, 576, 579, 582; skeleton, 589
 Malmby Creek, 516
 Malpighian body, 607, 608
 Maltese Is., fauna, 448; palæontology, 541; vernacular names, 600
 Malthe, 661
 Malthidæ, 661
Malthopsis, 416
 Malton, 517, 535
 Mamfe-Schiefern, 536
 Mammoth Cave, 375, 427
 Man-eater Shark — see *Carcharodon*
 Man, Isle of, 442
 Manáos, 433
 Manar, Gulf of, 435
 Manchester, England, 517
 Manchuria, 436
 Mandibles, 520, 584, **592**, 612
 Mandibularis externus facialis nerve, 525
 Mandibularis trigemini nerve, 526
 Mangala, 422
 Mangareva Is., 456
 Mangishlak Penin., 539
 Manila, 516
 Manitoba, 531
 Manometric apparatus, 381
 Manquae, Lake, 457
 Mansfeld, 534
 Mansfield, 532
Manta, 366, **621**
 Manti Beds, 538
 Manuals, 494, 495
 Maps, 405
 "Maräne" — see *Coregonus*, European species
 Marajo I., 433
 Marcus I., 456
Marcusenius, 378
 Margarethen, Leithakalk, 541
 Mariana Is., 456
 Marine biological stations, 469, 470, 568

- Marine fish farming, 564, 566
 Maritime Prov., Siberia, 439
 Markets, **468**, 471, 480, 481, 488; transportation to, 463; prices, 484
 Marking experiments, 516 — see also Migrations
 Marl, glacial, 542
 "Marl slate," 534
 Marlborough, 442
 Marne R., 557
 Marquesas Is., 456
 Marseilles, fauna, 445; fisheries, 467, 472, 483; mortality at, 516; plankton survey, 571
 Marsh Coll., 519
 Marshall Is., 456, 574
 Marsipobranchii, 615 — see also Cyclostomata
 Marsupium, 420, 578
 Martha's Vineyard I., 428
 Martinique, 431
 Marutea, 456
 Maryland, fauna, 428; fisheries, 478; palæontology, 531, 538, 540; pisciculture, 569
 Masai R., 421
 Mashonaland, 423
 Massachusetts, 469, 515, 554, 576; fauna, 428; fisheries, 478; museums, 519; palæontology, 534; pisciculture, 561, 562, 563, **569**
 Mastacembelidæ, 661
Mastacembelus, 379; taxonomy, 661
 Mating habits, 582
 Mattamuskeet, Lake, 429
 Matto Grosso, 433
 Maturation of ovum, 529
 Maturity, 587
 Maumee R., 427
 Mauritius I., 437, 574
Maurolicus, 513, 514, 633
 Mauthner's fibers, 596
 Maximilian I., 462
 Maxinkuckee, Lake, 427
 Mayflies as food, 555
 Mazatlan, 432
 Mazon Creek, 532
 McCloud R., 426, 516, 562
 McDonald hatching apparatus, 555
 Mecklenburg, 605
 Mediæval literature, 505
Medical Properties, 404, 408, 466, **514**, 573
 Medical zoologies, 495
 Mediterranean Sea, expeditions, 396; fauna, 396, 405, 448, 449, 574; fisheries, 474, **485**; fish farming, 566; plankton surveys, **571**, 572
 Medulla, 387, 407, 413, 524, 597, 598; as respiratory center, 583
 Medusa-eater — see *Schedophilus*
Megalichthys, 401, 622
Megalobrycon, 634
Megalops, 371, 379, 503, 572, **625**
Megistopus, 491
 Melanesia, 456
 Melanism, 394
Melanocetus, 661
Melanostomus, 513
Melanotania, 645
 Meleda I., 439
 Melianah, 564
 Melrose, Scotland, 532
Membrana limitans, 419, 524
Membrana nictitans, 419
Membrana reunions, 611, 612
 Membrane bones, 592, 593
 Membranous labyrinth, anatomy and development, 379, **380**; as auditory organ, **379**, 380, 501, 502; as equilibrium organ, **501**, 502
 Memory in fishes, 382
 Menam R., 438
 Mendota, Lake, 516
 Menhaden — see *Brevoortia*
Menidia, 645; nerves, 524, 526; ova, 529; skeleton, 589
 Meninges, 391, **524**
 Meninx primitiva, 524
 Mensuration — see Growth
 Mentawi Is., 456
 Menzaleh, 421
Merganser (bird), 488
Merluccius, 394, 409, 498, 499; hake liver oil, 466; ova and larvæ, 572, 577; fisheries and occurrence, 647
 Meroblastic cleavage, 411
 Merocytes, 411
 Merrimac R., 554
 Mesencephalon, 387, 524, 526
 Mesenchyme, 390, **412**, 509, 510, 587, 612
 Mesenteric arteries, 390
 Mesenteric folds, 493
 Mesoblast — see Mesoderm
 Mesoderm, 401, **412**, 458, 509, 510, 515, 589
Mesogonistius, 415, 499; in aquaria, 373; sexual dimorphism, 587
Mesonauta, 374
Mesonephros, 598, 606, **607**, 608, 609
 Mesopotamia, 439
 Mesopterygium, 461
 Mesozoic fossil fishes, 534–538
 Messina, 451
 Metabetchouan R., 425
 Metabolism, 522, 551; of salmon, 630
 Metachromatism, 394
Metamerism, 500, 509, **514**, **515**, 591, 610
 Metanephros, 606, 607
 Metapterygium, 461
 Metencephalon, 387
 Methods — see Technique and Methods
Metynnis, 377
 Metz, 483
 Meuse R., 554, 565
 Mexican Sword-tail — see *Xiphophorus*
 Mexico (chiefly Gulf of), 516, 519, 556; fishing methods, 372, 489, 491; fauna, 425, 431, 432; fisheries, 473
 "Michael Sars," 396, **486**
 Michaelstein, 567
 Michigan (including Lake Michigan), fauna, 425, 428; fisheries, 478; fishes introduced, 558, 563; pisciculture, 563, 564, **569**
Micralestes, 377
Microcotyle (parasite), 545
 Microcyprini, 375, 376, 590, **642**, **643**
Microgadus, 647
 Micronesia, 456
Micropterus, 371, 394, 419, 479, 493, 499, 545, 586, **648**; embryology, 415; food, 493; hibernation, 504; culture, 560, 561, 569; reproduction, 576; nests, 579; skeleton, 590; "Mopskopf," 604
 Micropyle, 528, 529
 Microstominae, 633
 Mid-brain, 387 — see also Mesencephalon
 Middle America — see Central America
 Middle I., N. Z., 457
 Midi, 483
Migrations, **515**, **516**; influence of light, 382; memory, 382; overland, 513; Palæozoic migrations, 515; marking experiments, 516; parasites as clue to, 543; marine fishes, 552; temperature effects, 602; of salmon, 630, 631
 Milan, 467, 518
 Milk R., 536
 Miller's Thumb — see *Cottus*
 Millions Fish — see *Lebistes*
 "Millstone Grit," 533
 Milt, 505, 507, 595
Mimagoniates, 377
 Mimicry, 393
 Minas Geraes, 433
 Mindo, 434
 Minho R., 452
 Minnesota, 428, 516, 544
 Minnows, 492 — see also Cyprinodontidæ

- Minous*, 395
 Miocene fossil fishes, 540-542
 Miquelon I., 424
 Misaki, 469
Misgurnus — see *Cobitis*
 Misol I., 455
 Mississippi, fauna, 428; fisheries, 478; palæontology, 536
 Mississippi R., 474, 557, 558
 Mississippi Valley, 493
 Missolonghi, Lagoon of, 484
 Missouri, fauna, 428; palæontology, 531, 532, 533; trout introduced, 558; pisciculture, 569
Mistichthys, 498
Mitsukurina, 385, **619**
Mixonus, 385
 Mjatschkowa, 533
Mobula, 499, 583, 586, 613; occurrence, 621
 Moeraki, 457
 Mörkö, 452
 Mogilev, 568
 Moiou I., 456
 Mokattam Hills, 538
 Mokohinou Is., 457
Mola — see *Orthogoriscus*
 Molidæ, 662
Mollienisia, 376, 506, 582, 643
 Mollusca, parasitic, 544; as food, 564
 Molucca Is., 455, 564
Molva, **647**; food of, 493; hermaphroditism, 504; ova and larvæ, 572; abnormal backbone, 604
 Mombus, 421
 Monacanthidæ, 402, 449, 574
 Monaco, 396, 518
 Monadnock Lake, 428
 Mondaino, 541
 Mongolia, 436
 Monocentridæ, 590
Monocentris, 458
Monocirrus, 374, 393
Monocotyle (parasite), 545
 Mononephros, 606, 607
 Monongahela R., 429
Monopterus, 389, 583; taxonomy, 637
 "Monorhinie," 527
 Monsembé, 422
 Monsoons, 516
 Monsters, 602
 Monstrosities, 604, 605
 Mont d'Or, 536
 Montagna, 565
 Montagua R., 431
 Montana, fauna, 428; palæontology, 536, 538; pisciculture, 569, 570
 Monte Bello Is., 453
 Monte Bolca, 518, **539**
 Monte Foraporta, 536
 Monte Postale, 539
 Monte S. Agata, 537
 Monte Titano, 541
 Montegazzo, 541
Montella, 461, **647**
 Monterey, 426, 469
 Monterey Bay, 426
 Montiggler See, 440
 Montluçon, 444
 Montmartre gypsum, 539
 Montpelier, Idaho, 532
 Montpellier, 542
 Montrose, 443
 Moon, effects of, 574
 Moore Fossil Coll., 517
 "Mopskopf," 604
 Morat, Lake, 453
 Moravia, 440, 480
 Moray Firth, 443
Mordacia, 368, 616
Moringua, 641
 Mormyridæ, **626**; abdominal pores, 361; brain, 385, 387; pseudo-electrical organs, 407; cranial nerves, 525; skeleton, 589; skull, 594; spinal cord, 596
Mormyrus, 361, 380, 626; anatomy, 369; electrical organs, 406, 407
 Morocco, 422
 Morone, 528
 Morotai I., 455
Morphological section, 361 f.
 Morphology — see Anatomy, 367 f.
Morrhua — see *Gadus morrhua*
Mortality, 406, **516, 517**, 548, 552, 584, 599; destructive fishes, 559, 560; noxious organisms, 559, 560; asphyxiation, 584; caused by temperature, 601, 602
 Moscardo Coll., 518
 Moscow, 467, 518
 Moselle R., 445, 446
 Mosquito destruction, 404, 492, 559
 Mossamedes, 538
Motella, 521, 599, 603; embryology, 411, 415; ova and larvæ, 572
 "Moulting," 551
 Mount Kenia, 421
 Mount Lebanon, 537
 Mount Whitney, 426
 Mousefish — see *Pterophryne*
 Mouth, 381, 395, 412, 498, 599; Dohrn's theory, 365; muscles, 520; parasites, 544; oral gestation, 579, 580; buccal occlusion, 604
 Moy R., 471, 481
 Mozambique, 421, 540
 Mucosa, 403, 509, 510, 511, 581, 586, 588
 Mud Minnow — see *Umbra*
 Müggel See, 470
 Mühlhausen, 540
 Mühlthal, 537, 567
 Müllerian ducts, **607**, 609, 610
Mugil, 370, 379, 394, 399, 511, 514, **645**; fisheries, 472; as whitebait, 474; angling for, 490; hermaphroditism, 504; migrations, 516; culture, 559, 562, **566**, 567; breeding habits, 576; respiration, 583; skeleton, 589; "Mopskopf," 604; urinogenital system, 610
 Mugilidæ, 645
 Mullet — see *Mugil*; Red Mullet — see *Mullus*
 Mullidæ, 650
Mullus, 375, 415, 499, 599, 610, **650**
 Mummified fishes, 379, 421
 Mundesley, 542
 Munich, 518, 567
Muræna, 391, 509, 550, 612, 641; poison apparatus, 573
 Murænesocidæ, 589
Murænesox, 641
 Murænidæ, 387, 511, 613, 641; embryology, 411, 412, 413; nerves, 526; skull, 593; reproduction, 609; vertebral column, 612
 Murman Coast, 450
 Murray R., 454
 Murrumbidgee R., 454
 Murtner See — see Morat, Lake
 Muscles — see Myology
 Musculus retractor lentis, 614
 Musculus sphincter uterorum, 581
 Musée Océanographique, Monaco, 518
Museums, 392, **517-519**
 Musical fishes, 594, 595
 Muskallunge — see *Esox*
 Muskoka Lake, 425
 Mussels, larval parasitic forms, 544
Mustelus, 389, 398, 419, 492, 496, 511, 520, 527, 594, 613, 618; brain, 385, 387; embryology, 414, 581; cranial nerves, 524, 526; skull, 591
 Mutation, 415, 416
 Myctophidæ, 514
Myctophum, 418, 642
 Myelencephalon, 387
 "Myelocytes," 523
Myletes, 377
 Myliobatidæ, 398, **620, 621**
Myliobatis, 580, 603, **621**
Mylocheilus, 381, 404, 492, 577
Mylostoma, 664, 665
 Myocardium, 502

- Myocommata, 520
 Myodome, 592
Myology, 493, **519-521**, 551, 575, 584, 599
Myoxocephalus, 499, 658
Myriacanthidæ, 621
Myriacanthus, 401, 586
Myripristis, 590, 647
Mythology and Symbolism, **521**; Christian fish symbol, 605
Myxine, 380, 383, 390, 394, 543, 611; abdominal pores, 362; intestine, 366; anatomy, 368; brain, 385, 387, 388; embryology, 413; eye, 418; "pre-anal fin," 459; hermaphroditism, 503; integument, 509, 510; muscles, 520; nervous system, 522, 523, 524; ova and ovum, 528, 529; gills, 585, 602; skull, 592; spermatogenesis, 595, 596; spinal cord, 596; thyroid gland, 606; urinogenital system, 607; natural history and taxonomy, 616
Myxinidæ, 362, 367, 368, 524, 525, 607, **616**
Myxinoides, 615, 616
Myxoboliasis tuberosa, 549
Myxobolus (parasite), 549
Myxopterygia — see Claspers, 400, 401, **580**, **581**
Myxosporidia (parasites), 547, 549, 550

 Nahuel Huapi, Lake, 570
 Namur, 531
 Nanaimo, 424
 Nancowry, 437
Nandidæ, 374, **648**
Nandus, 374
Nannacara, 374, 651
Nannostomus, 377
 Nantucket I., 428
 Napier, 457
 Naples, 468, 470, 518, 567; Gulf of Naples, 448, 485, 576; Naples Aquarium, 513
 Naphtha, 464
Narcacion, 581
Narcine, 368, 581
 Narcotics, 407, 488, 552, 553, 601
 Nasal organs, 526, 591, 593; nares, 365, 527, 594; olfactory functions, 382, 386, 525, **527**, **594**
 Nashua R., 570
 Nashville, 466
 Natal, fauna, 422; palæontology, 532, 536; trout introduced, 558; pisciculture, 564
 National Park Dam, N. S. W., 516
 National salmon park, 562
 Native fishing methods, 488 f.
 Natrol Valley, 542
 Natuna Is., 455
 Natural history, general works, 494, 495; of particular fishes — see in Systematic Section
Naucrates, 395, 652
 Nauta, 435
 Navesink R., 570
 "Nebenherzen," 390
 "Nebenhoden" — see Leydig's gland, 608
 Nebraska, 428, 493, 532, 533
Nebris, 650
 Neckar R., 447, 516
 Nectonic fishes, 362, 493
Neetroplus, 374
 Neilgherry Hills, 564
 Nelson Harbour, 457
Nemachilus, 364, 394, 509, 636
Nemathelminthes (parasites), 546
Nematoda (parasites), 546
Nematognathi, 637
Nemichthyidæ, 572, 641
Nemichthys, 641
Nemophis, 659
 Nene R., 506, 556
Neoceratodus, **625**; air-bladder, 364; intestine, 366; anatomy, 368; in aquaria, 373; auditory organs, 380; blood, 383; brain, 385; circulatory system, 389, 390; dentition, 398; scales, 402; embryology, 411, 412, 413, 414; head, 500; heart, 502, 503; liver, 512; muscles, 520; nervous system, 523, 524; pancreas, 543; physiology, 553; reproduction, 576; gills, 585; skull, 593; spleen, 597; pronephros, 608; visceral skeleton, 612; fossil form — see also *Ceratodus*
Neochanna, 641
Neolebias, 377
Neomænis, 504, 649
 Neoplasms, 547
Neosilurus, 587
Neosporidia (parasites), 549
 Nepal, 436
 Nephridia, 606, 607
 Nephrophagocytes, 384
Nerophis, 578, **644**, 645
Nervous System, 500, 502, 509, 515, 520, **521-527**, 584; cranial nerves, 388, 515, **525**, 590; physiology, 394, 522, 523, 601; neuroglia, 419, 523; central, 512, **523**, 524; peripheral, 524-527; sympathetic, 527; diseases of, 547; regeneration of, 575; taxonomic value, 599; abnormalities, 604
 Nest-building, 382, 578, 579
 Netherlands, fauna, 449, fishermen, 462; fisheries, 467, 470, **472**, 473, 474, **485**; museums, 518; palæontology, 538; pisciculture, 548, 567, 568; fishes introduced, 556, 557; vernacular names, 600
 Nets, 463, 489
 Netuma, 580
 Neu Pommern, 456
 Neuchâtel Lake, 453, 487
 Neueselt, 535
 Neural arches, 458, 611
 Neural crest, 522
 Neurenteric canal, 413
 Neuse R., 429
 Neustadt, 447
 Nevada, 406, 570; fauna, 428; palæontology, 532, 538, 540, 542
 New Britain, 456, 488
 New Brunswick, fauna, 424; fisheries, 471, 475; palæontology, 531, 532; salmon introduced, 557
 New Caledonia, 456, 574
 New England, 471, **477**, 557, 600
 Newfoundland, fauna, 424; fisheries, 471, 475; pisciculture, 569
 New Guinea, 405, 580; fauna, 455, 456; fisheries, 488; fishing methods, 489, 490; fish totems, 521
 New Hamburg, 563
 New Hampshire, fauna, 428; fisheries, 478; trout and salmon introduced, 557, 558; pisciculture, 570
 New Hanover, 456
 New Hebrides, 456
 New Ireland, 456
 New Jersey, fauna, 428, 429; fisheries, 478; palæontology, 534, 535, 536, 537, 538, 540; salmon introduced, 557; pisciculture, 570
 New Mecklenburg, 456
 New Mexico, 429, 532, 533, 538
 New Red Sandstone, 535
 New South Wales, 516, 574; fauna, 454; fisheries, 466, 467, **488**; palæontology, 533, 534, 536, 538; carp sucker introduced, 558; pisciculture, 570
 New York, fauna, 429; markets, 468; fisheries, 478; museums, 519; palæontology, 531; fishes introduced, 556, 557, 558; pisciculture, 570

- New York Aquarium, 562
 New York City, 429, 519
 New York Hatchery, 507
 New Zealand, fauna, 397, 457; fisheries, 470, 488; palæontology, 538, 540, 542; fishes introduced, 556, 557, 558; pisciculture, 570; vernacular names, 600
 Newsham colliery, 533
 Ngami, Lake, 421
 Nias I., 456
 Niatchkovo, 533
 Nicaragua, 432
 Nicaragua, Lake, 552
 Nice, 444, 474, 483
 Nicobar I., 437
 Nictitating membrane, 419
 Nidamental glands, 528
 Nidification — see Nest-building
 Nied R., 446
 Niederlausitz, 567
 Niederschönthal, 535
 Niger R., 423
 Nigeria, 423
 Nigg, Bay of, 482, 548, 561
 Nijne-Taguilsk, 568
 Nikolaievsk, 438
 Nikolsk, 568
 Nile R., 423, 468, 475
 Ningpo, 436
 Nipissing, 425
 Nitro-glycerine, 488, 489
 Nitrogen, 384
 Niu-chuang, 436
 Nomenclature, 388, 536, 599, **600**; of hybrids, 505, 506, 507 — see also the various countries
Nomeus, 395
 Noosing fish, 490
 Norfolk, 468
 Norfolk I., 454
 Normandy, 445, 566
 Norrnäs, 462
 North America, 516, 518, 528, 543, 544, 545, 576; angling, 371, 372, 498; palæontology, 416, 530, 531, 532, 533, 534, 535, 536, 537, 538, 540, 542; fauna, **423-425**, 580; fisheries, **464**, 466, 469, 471, 472, 473, **475-479**; markets, 468; historical, 505; iconography, 508; museums, 519; fishes introduced, 556, 557, 558, 559; pisciculture, 562, 563, 569, 570
 North Cape, N. Z., 457
 North Carolina, 515; fauna, 429; fisheries, 469, 478; palæontology, 534, 540; pisciculture, 563, 569
 North Dakota, 429, 559, 569
 North I., N. Z., 457
 North Sea, 464, 506, 543, 559, 576; fauna, 446, 449; food fishes, 462; fisheries, 470, **471**, 474, 480; marking experiments, 516; pisciculture, 561, 565; plankton surveys, 571; spawning grounds, 577, 578
 North Uist, 442
 Northern Ribbonfish — see *Trachipterus*
 Northville, 564
 Norway, 465, 507, 515; fauna, 449; fisheries, 462, 467, 470, **472**, 473, 474, **485**, **486**; palæontology, 531, 542; pisciculture, 559, **561**, **568**
 Norway Pout — see *Gadus esmarkii*
 Norwich Castle Museum, 518
Nosema (parasite), 550
 Nossi Bé I., 422
 Nostrils — see Nasal organs
 Notacanthidæ, 643
Notesthes, 573
 Notidanidæ, 617
Notidanus, 390, 398, 524, 526, 613, **617**; pre-sternum, 550; sexual dimorphism, 586; excretory organs, 608
 Notochord, 387, 588, 591, 596, 610, **611**, 612; parasites of, 545; abnormal, 604
 Notopteridæ, 361, 512, 594
Notopterus, 364, 380
 Nototheniidæ, 659
Notropis, 378, 636
Noturus, 410, 573, 637
 Noura R., 438
 Nova Scotia, fauna, 424, 425; fisheries, 476; palæontology, 531, 532; pisciculture, 569
 Nova Zembla I., 450
Noxious Organisms, 489, 490, **559**, **560**
 Nucleic acid, 528
 Nudibranchs, 555
 Nürnberg — see Nuremberg
 Nukahiva, 456
 Nuremberg, 518, 605
Nuria, 378
 Nurse cells, 595
 Nurse Shark — see *Ginglymostoma*
 Nuskhi, 435
 Nusplingen, 536
 Nussalaut I., 455
 Nutrition — see Food of fishes
 Nyasaland, 532
 Nyassa, Lake, 423
 Nyborg, 470
 Oamaru system, 540
 Oarfish — see *Regalecus*
 Oban, 532
 Obbia, 423
 "Oberhaut," 509, 510
 Obernkirchen, 537
 Obi R., 439
 Obi Major I., 455
 Obok, 423
 Occipital region, 500, 591
 Occurrence — see Distribution; of particular fishes — see Systematic Section
 Ocean City, 428
 Oceanica, Wallace's line, 405; fauna, 453-457; fisheries, 470, 488; palæontology, 531, 532, 533, 534, 535, 536, 538, 540, 542; pisciculture, 570, 571
 Oceanography, 462
Octobothrium (parasite), 545, 547
 Oculo-motor apparatus, 419, 525
Ocyurus, 504
Odax, 393
 Odense Society (pisci.), 565
 Odessa, 450
Odontaspis, 619
 Odontoblasts, 588
 Odontology — see Dentition
 Oeningen, 541
 Oesel I., 450, 531
 Oesophagus, **365**, 390, 391, 492
 Ogowe R., 422
 Ohio, fauna, 429; fisheries, 478; museums, 519; palæontology, 531, 532; shad introduced, 558; pisciculture, 569
 Oil, **466**; of Ruvettus, 514
 Oil Shark — see *Galeorhinus*
 Oken — see Goethe-Oken
 Oklahoma, 532, 537
 Okoboji, Lake, 427
 Old Calabar, 423, 552
 Old Red Sandstone, 531, 532
 Old Stone Age, 379
 Oldenburg, 518
 Olfactory lobes, 386
Olfactory Organs, 386, 525, **527**; sense of smell, 382, 594
 Oligocene fossil fishes, 539, 540
Oligocottus, 395
Oligopus — see *Gadopsis*
 Oman, Gulf of, 435
 "Ombre-chevalier" — see *Salvelinus*
Onchosaurus, 634, 664
Oncorhynchus, **630**, 631 — see also Salmon
 Onega, Lake, 450
Oneirodes, 661
 Onon R., 438
 Ontario, Lake, 425, 476, 557
Onus — see *Motella*
 Oögenesis, 529
 Oölites, 535

- Operculum, 416, 419, 584, **592**; age determined by, 497; regeneration, 575; abnormal opercular gills, 602
- Ophichthyidæ, 527
- Ophichthys*, 393, **641**
- Ophidiidæ, 582; taxonomy, 660
- Ophidion*, 369
- Ophidium*, 364, 369, 395, 609
- Ophiocephalidæ, 584, 646
- Ophiocephalus*, 363, 370, 415; nests, 578; skeleton, 589
- Ophisurus*, 369
- Ophthalmicus profundus nerve, 526
- Opisthomi, 590, **661**
- Opisthonephros, 607, 609
- Oplegnathidæ, 649
- Oppeln, 541
- Opsanus*, 395, 409, 499, 511, 573, **659**, 660; embryology, 410, 412, 413, 414; nests, 579
- Optic lobes, 387
- Optic vesicle, 418
- Oral cavity, 365
- Oral gestation, 579
- Orange Free State, 534
- Orbetello Lagoon, 448
- Orbital wall, 419
- Orbitosphenoid, 592
- Orciano, 542
- Orcynus* — see *Thynnus*
- Ordovician fossil fishes, 530
- Orectolobinæ, 618
- Oregon, fauna, 429; fisheries, 473, **478**, **479**; palæontology, 542; shad introduced, 558; pisciculture, 569
- Oreoleuciscus*, 636
- Oreosoma*, 653
- Orestias*, 399, 435, **643**
- Orfe — see *Leuciscus*
- Orinoco R., 434 435
- Orizaba, 432
- Orkney Is., 443, 482, 532
- "Oroya," 556
- Orthagoriscus*, **662**; anatomy, 370; auditory organs, 380; brain, 385, 386, 388; circulatory system, 390, 391; dentition, 399; scales, 402; eye, 418; size, 498; habits, 499; skin, 509; nervous system, 523, 526, 527; parasites of, 544; ova and larvæ, 572; alleged viviparity, 582; gills, 585; skeleton, 589; spinal cord, 596; larval form — see *Malacanthus*
- Orthoprists*, 497
- Os intercrural, 380
- Osino, 540
- Osmerus*, 415, 458, 528, **633**; angling for, 371, 488; growth, age, etc., 497, 633; ova, 529; culture, 563, 567; fisheries, 633
- Osmotic pressure, 551
- Osphromenidæ, 374, 375, 578, **650**, **651**
- Osphromenus*, 651; in aquaria, 375; introduction, 556, 557; alleged viviparity, 582
- Ossification, 588
- Ossolani, Lake, 567
- Ostariophysii, anatomy, 369; in aquaria, 377, 378; Weberian apparatus, 380; embryology, 415; food of, 493; habits, 499; breeding, 576; spawning, 577; sexual dimorphism, 587; skeleton, 588, 589; skull, 594; fossil form, 634; taxonomy, 634
- Ostende, 462
- Osteoblasts, 588, 589
- Osteogeniosus*, 577
- Osteoglossidæ, 361; oral gestation, 580; skull, 594; taxonomy and distribution, 626
- Osteoglossum*, 378, 499, 580
- "Osteoides Gewebe," 588
- Osteolepida, 622
- Osteolepidæ, 401, 622
- Osteology, 587-590; exhibits, 518
- Osteorachis*, 624
- Osteostraci, 401, **663**
- Ostracion*, 402, 543, 662
- Ostraciontidæ, 662
- Ostracodermi, 401, **663**, 664
- Otago, 457
- Otocinclus*, 378
- Otoliths**, 380, 501, **527**; age determination by, 497
- Otranto, 542
- Otsego Lake, 569
- Ottawa, Kansas, 427
- Ottawa R., 542, 579
- Otter fishing, 489
- Otter-trawl, 463
- Oued Rir, 421
- Oulachan — see *Thaleichthys*
- Ourthe R., 554, 565
- Ouse R., 442, 552
- Ova and Ovum**, 361, 382, 409 f., 416, 482, 503, 504, 505, **528**, **571**, **572**, 574, 577, 607, 609, 610; cleavage, 409, 410, **411**, 413; size and weight, 409, 410; impregnation, 410, 555, 595; roe as food, 465, 472, 474; hybrid eggs, 505, 507; oögenesis, 529; diseases and parasites, 547, **549**, 602; counting methods, 554; adhesive, 555, 563; effect of food, 555; destruction, 559; egg rafts, 571, 578; attachment to body, 572, 578; fecundity, 576; oviposition, 577, 578; parental care, 578-580; effect of temperature, 601 — see also Reproduction
- "Ovals," 363
- Ovaries, 382, 503, 504, 551, 608, **609**; diseases of, 547, 608; ovarian gestation, **582**; Wolffian ducts, 606, 607
- Over-fishing, 464
- Overland progression, 512, 513
- Oviducts, 411, 528, **609**, **610**; degeneration, 361; oviducal gestation, 580-582; abnormal, 603; Müllerian ducts, **607**, 609, 610
- Oviparity, 506, **580**, 595; pseudo-copulation, 576, 577
- Oviposition, 577, 578
- Ovotestis, 503, 607
- Ovoviviparity, 580
- Owens College Mus., 517
- Oxford, 518, 542
- Oxford Clay, 535
- Oxybeles* — see *Fierasfer*
- Oxyrhina*, 390, 581, 619
- Pachycormidæ, 624
- Pacific Ocean, 405, 513; dredging operations, 397, 477; fauna, 431, 574; fisheries, 477; fishing methods, 489, 490; islands of — see Oceanica
- Packing — see Transportation
- Padang, 538
- Paddlefish — see *Polyodon*
- Pagellus*, 375, 603, 650
- Pagrus*, 650
- Pain, sensibility to, 381
- Palæaspis*, 663
- Palæo-selachii, 523
- Palæobalistes*, 662
- Palæolithic, Upper, 379
- Palæoniscidæ, 575, 622
- Palæontology**, 379, 416, **529** f., museum exhibits, 517, 519
- Palæorhynchidæ, 652
- Palæorhynchus*, 652
- Palæospondylidæ, 663
- Palæospondylus*, 663
- Palæozoic fossil fishes, **530-534**; body form, 493; migrations, 515; exhibit, 519
- Palatoquadrate bones, 592
- Palawan, 457
- Paleocene fossil fishes, 538, 539
- Palestine, 439
- Palisade cells, 510
- Palistrophy, 604
- Palo de la flecha (poisonous plant), 489

- Palpebral apparatus, 419
 Pamir, 438
 Pan-American Exposition, 466
 Panama, fauna, 432, 580; palæontology, 540
Pancreas, 403, **542**, **543**
 Panguitch Lake, 569
Pantodon, 378, 491, 577, **626**
Pantodontidæ, 594, 626
 Papua, 455, 456 — see also New Guinea
 Para, 519, 537
 Paradise Fish — see *Polyacanthus*
Paraglyphidodon, 375
Paragoniates, 377
 Paraguay, 435
 Parahyba, 537
 Parahyba do Norte, 537
Paralepis, 642
Paralichthys, 657
Parambassis, 649
 Paraná, 433, 542
 Paranagua, 433
 Paraphysis, 386
Parascaphirhynchus, 623
Parascyllium, 577
Parasilurus, 576, **636**
Parasites of Fishes, 403, 404, **543-546**, 547-550; crustacean, 543, 544; molluscan, 544; worm, 544, 545; protozoan, 548, 549, 550
Parasitic Fishes, **546**
 Parasphenoid, 591
Paratilapia, 374
 Parental care, 578-580
 Parietals, 592
 Paris, 463, 467, 566; markets, 445, 468
 Paris Basin, palæontology, 537, 539, 540
 Parma, 518
 Parnahyba, 433
Parosphenomenus, 375
 Parr, 629
 Parrot Wrasses — see *Scaridæ*
 Parschlug, 540
 Parthenogenesis, 409
 Parturition, 580, 582
 Passau monastery, 483
 Passes, 554
 Patagonia, 433, 537, 540
 Patani, 438
Pathology of Fishes, 388, 516, 544, **546-550**, 565; parasitic diseases, 543-546; human pathology — see Diseases of Man
 Patia R., 434
 Patzcuaro, Lake, 432
 "Paul and Peter," 605
Paullinia (poisonous plant), 489
 Paumotu Is., 456
 Peace Creek, 542
 Pearl organs, 510
 Pearl-shellhook, 489
 Pearls, artificial, 464, 465, 510, 511
 Pebas, 434
 Pechora R., 450
Pectoral Girdle, 461, **550**, **551**
Pediculati, **661**; anatomy, 370; embryology, 415; skeleton, 590; skull, 594
 Peduncle, 603
Pegasus, 369
 Pegu Beds, 541
 Pei-Ho, 436
 Peipus, Lake, 450, 486
 "Peipus Maräne," 564 — see also *Coregonus*
 "Pejeray" — see *Atherinichthys*
Pelagic fishes, 395, **551**; adaptations, 362; ova and larvæ, 571, 572; nests, 579
 Pelau Is., 600
Pelmatochromis, 374
Pelvic Girdle, **551**, 604
 Pelvis — see Pelvic Girdle
Pempheridæ, 647
 Penang, 438
 Pend d'Oreille R., 570
 Pendulation theory, 404
Penella (parasite), 544
 Pennsylvania, 464, 554; fauna, 429; fisheries, 466, 479; museums, 519; palæontology, 531, 533; pisciculture, 569
 Penobscot R., 473, 562
Pentacerotinæ, 649
Pentaprion, 650
Pentapus, 650
 Pepin, Lake, 428
 Pepsin, 365, 403
 Pérak, 438
Perca, **648**; æstivation, 363; angling for, 371; in aquaria, 375; color, 393; scales, 402; parasites of, 404, 545, 546; embryology, 411, 414; eye, 418; glue, 466; variation, 491, **648**; habits, 499; hermaphroditism, 504; hybrid, 507; nervous system, 522; introduction, 559, 569; culture, 564, 568; breeding habits, 576; spawning, 577; sound, 595; spinal cord, 596; teratology, 603, 604, 605
 Percaglobulin, 528
Percalates, 558, 570, 649
Percesoces, **645**, 646; anatomy, 370; in aquaria, 379; embryology, 415; ova and larvæ, 572; breeding habits, 576; skeleton, 589
 Perch — see *Perca*; Climbing Perch — see *Anabas*
Percidæ, 375, 587, 593, 647, **648**
Perciformes, **647-653**; an-
 atomy, 369; embryology, 414, 415; habits, 499; ova and larvæ, 572; taxonomy, 647
Percina, 576, 610
Percinæ, 647
Percoidea, 404, 511
Percopsidæ, 590, 643
 Periblast, 411
 Peribranchial cavity, 584
 Pericardium, 503
 Perichondrium, 588
 Perichromatin, 407
Periodicals, **348 f.**
Periophthalmus, in aquaria, 374; habits, 382, 499; eye, 418; locomotion, 461, 513; respiration, 584; taxonomy, 657
 Periotic capsules, 380
 Periscopism, 419
Peristedion, 599
 Peritoneum, 393, 503, 610; peritoneal canals, 361, 362, 608, 609; color, 510
 Peritonitis, 545
 Perledo, 535
 Perm Govt., 451
 Permian fossil fishes, 533, 534
 Pernambuco, 537
 Pernau R., 464
 Péronne, 537
 Persia, 438, 480, 537, 541
 Peru, 516; fauna, 405, 435; fisheries, 479
 Perugia, Lake, 448
 Pestis rubra anguillarum, 548
Petalodontidæ, 618
Petalosoma, 376
Petalurichthys, 376
 Peter the Great Bay, 438
 Peterborough, England, 535
Petersius, 377
 Petiveriani, Mus., 517
 Petrograd — see St. Petersburg
Petromyzon, abdominal pores, 362; "salivary" gland, 365; intestine, 366; anatomy, 368; in aquaria, 373; auditory organs, 380; blood, 383, 384; brain, 385, 387; circulatory system, 389, 390, 391; xanthochroism, 394; dentition, 397; embryology, 410, 411, 412, 413, 414; eye, 418, 419; caudal skeleton, 459, 575, 603; as food, 465; taste buds, 498; head, 500, 502; hermaphroditism, 503; epidermis, 510; liver, 512; migrations, 513, 515; muscles, 519, 520, 521; nervous system, 522, 523, 524, 525, 527; otoliths, 527; oögenesis, 529; pancreas, 543; parasitic habits, 546; predatory

- habits, 559; culture, 569; regeneration, 575; breeding habits, 576, 577, 579; respiration, 583; gills, 585, 602; skull, 592; sperm, 596; spinal cord, 596; spleen, 596; double monstrosities, 604; thymus glands, 605; thyroid gland, 606; excretory organs, 608; variation, 610; vertebral column, 611; visceral skeleton, 612; natural history, **616**; larval stage — see *Ammocoetes*
Petromyzontes, 616
Petromyzontidae, **616**; anatomy, 368; brain, 385, 387
Petschora R. — see *Petschora* R.
Phæochrome tissue, 598
Phago, 377
Phagocytosis, 384
Phalloceros, 376
Phalloptychus, 376
Phallostethus, 369, 582, 643
Pharyngognathi, 588, 647
Pharynx, **365**, 397, 520, 527, 584, 605 — see also *Visceral clefts*, 613
Philadelphia, 466, 519
Philichthyidae (parasites), 544
Philippine Is., fauna, 457, 574; economic products, 464, 466; fisheries, 488; fishes introduced, 556, 559; pisciculture, 571
Philothion, 403
Philypnus, 657
Phlyctænaspis, 665
Pholididae, 660
Pholidosteus, 665
Pholis, 414, 583, 660; nests, 579
 Phosphate beds, 540
 Phosphoglycoprotein, 528
 Phosphorescence, 513 — see also *Luminosity*
Photaxis, 382
Photoblepharon, 513, 514
 Photography, 601
 Phototropism, 382
Phoxinus, **636**; in aquaria, 378; color, 392, 394; fins, 461, 603; habits, 499, reproduction, 576, 577
Phractolæmidæ, 594
Phractolæmus, 379
Phreatobius, 382
Phycis, 493, 572
 Phylogeny — see *Evolution*
Physiology, 384, 386, **551–553**
Physoclisti, 364
Physometer, 600, 601
Physostomi, 364, 511, 588, 625
Piabuca, 399
Piako R., 457
Pianico, 542
Piauhay, 433
 "Piballes," 389
Pickrel, angling, 371, 488; embryology, 409; voracity, 559, 575 — see also *Esor*
Pickling fish, 469
Piedmont, 448
Piedra, 568
Piel-in-Barrow, 462, 469, 561
 "Pietra Leccese," 541
Pietraraja, 538
Pigment — see *Coloration*
Pike — see *Esor*
Pike-perch — see *Stizostedion*
Pilchard — see *Clupea pilchardus*
Pilot Fish — see *Naucrates*
 "Pilzkrankheit," 550
Pimelodus, 378, 380, 637
Pimelometopon, 587
Pimephales, 610, 636
Pinealis (Pineal body), 386, 387
Pinkus's nerve, 526
Pinoleus, 378
Pipefishes — see *Syngnathidae*
Piranhas — see *Serrasalmoninae*
Pirate Perch — see *Aphredoderus*
Piratinga, 573
Piscatory eclogues, 371
Pisces, 368 f., 616 f.
Pisciculture, 409, 410, 459, 464, 470, 482, **553–571**, 595; publications, 348, 476; hybrids, 505–507; by fishes, 560–564; by countries, 564–571
Pithecanthropus strata, 542
Pitt R., 554
Pittsburgh, 519
Pituitary body — see *Hypophysis*, 387
Placenta, 581
Placodermi, 592, **665**
Placoid elements, 397 f., 522
Placoidei, 399
Plagiostomi, 388, 465, 513, 544, 550, 574, 586, 601, **617–621**; abdominal pores, 362; intestine, 367, 390; anatomy, 368; brain, 385, 387; circulation, 391, 392; symbiosis, 395; dentition, 397, 398, 477; fossil forms, 397, 398, 461, 530, 617–621; dermal skeleton, 400, 402, 465; embryology, 414; fins, 460 f.; catching, 490; food, 492; size, 498; heart, 502; locomotion, 512; migrations, 515; muscles, 520; nerves, 522; reproduction and excretion, **528**, **580**, 581, 595, **608**; in fresh-water, 552; voracity, 574; jaws, 592; skull, 593; spinal cord, 596; suprarenals, 597; as Jonah's whale, 605; visceral skeleton, 612, 613
Plagusinae — see *Soleinae*
Plagyodus — see *Alepidosaurus*, 642
Plaice — see *Pleuronectes platessa*
Planktonic Fauna, **571**, **572**; adaptations, 362; as food of fishes, 492, 555
Planting — see *Pisciculture*
Plants, poisonous, 489, 490; fish-eating, 559; for fish ponds, 560
Platelets (blood), 384
Plates — see *Iconography*
Plattensee — see *Balaton Lake*
Platurus, 393
Platycephalidae, 658
PlatyGLOSSUS, 394; taxonomy, 651
Platyhelminthes (parasites), 545
Platypæcilus, 376, 392, 506
Platysomidæ, 622
Plecoglossus, 559
Plecostomus, 378
Plectognathi, **661**, **662**; air-bladder, 364; intestine, 366; anatomy, 370; in aquaria, 379; circulatory system, 389; scales, 402; muscles, 520; bone cells lacking, 588; skeleton, 590; skull, 594; taxonomy, 661
Plectorhynchus, 650
Pleistocene fossil fishes, 542
Pleuracanthidae, 616
Pleuracanthus, 461, 581
Pleurogramma, 460
Pleuronectes cynoglossus, 653, 654
Pleuronectes fesus, **653**; memory, 382; scales, 402, 602; fisheries, 471; static sense, 501; hybrids, 506; fins, 603; taxonomy, 610, 656; eye, 655
Pleuronectes limanda, 506, **653**; eye, 603, 655
Pleuronectes microcephalus, 653
Pleuronectes platessa, 499, 527, 575, 586, **653**; morphology, 369; in aquaria, 375; eggs and larvæ, 382, 576, **654**; circulation, 392; coloration, 394, **654**; scales, 402; eye, 418, 655; culture, 464, 470, 556, 559, **561**, 565, 568, 570; fisheries, 471; food of, 492; hybrids, 506; diseases, 548; fins, 575, 603;

- spawning, 577, **654**; respiration, 584; skeleton, 590; migrations, 656; taxonomy, 656, 657
- Pleuronectidae*, **653-657**; air-bladder, 364; development, 364, 496, **497, 654, 655**; intestine, 366; morphology, 369; circulatory system, 391; scales, 399; ambicoloration, 394, **654**; eye, 419, **655**; fins, 458, 601, 603; fisheries, 471; food of, 492; hybrids, 506; culture, **561, 570**; spawning, 577, **654**; respiration, 584; skull, 593; spinal cord, 596; distribution, 655; migrations, 656; phylogeny, 656; taxonomy, 656
- Pleuronichthys*, 657
- Pleuropterygii*, 616
- Plexus ophthalmicus*, 526
- Pliocene fossil fishes, 542
- Plöner See, 447, 559
- Plotosus*, 415, 573, 606
- Plummers I., 428
- Plunging buckets, 555
- Plymouth, 441, 469, 481, 571
- "Pockenkrankheit," 549
- Pocotaligo R., 430
- Podatellidae*, 660
- Podsused*, 541
- Pæcilia*, **643**; in aquaria, 376, 377; color, 392; embryology, 415; hybrid, 506
- Pæciliidae*, 404, 582, 586, 642 — see also *Cyprinodontidae*
- Pæciliinae*, 643
- Pæcilobrycon*, 377
- Pogonias*, 595; taxonomy, 650
- Pogonocharax*, 634
- Poisonous Fishes**, 393, 404, **572-574**
- Poisons (plant), 489, 552, 553
- Poitiers, 536
- Pola, 537
- Poland, 450, 486, 568
- Pollack — see *Gadus pol-lachius*
- Pollution, 464
- Polperro, 533
- Polyacanthus*, 364, 375, 414, 547, 585, 586, 602, **651**
- Polycentropsis*, 374
- Polycentrus*, 374
- Polychromism, 394
- Polyembryony, 409
- Polygonum* (poisonous plant), 489
- Polymixidae*, 590
- Polymorphism, 416
- Polynemidae*, 645
- Polynemus*, 466
- Polynesia, 456
- Polyodon*, **623**; abdominal pores, 362; anatomy, 369; blood, 383, 384; circulatory system, 390, 391; scales, 401; embryology, 414; fins, 460, 461; roe as caviar, 474; size, 498; heart, 502; lateral line, 511; muscles, 520; nerves, 522; breeding, 576; ribs, 586; skeleton, 589; skull, 593; tactile organs, 599; branchial arches, 613
- Polyodontidae*, 623
- Polypteridae*, 622
- Polypterus*, 401, 417, 461, 511, **622**; abdominal pores, 362; adhesive organs, 363; air-bladder, 364; anatomy, 369; auditory organs, 380; circulation, 390, 391; embryology, 411, 414; nervous system, 523; olfactory organs, 527; respiration, 584, 585; skull, 593; taxonomy, 622
- Polyspermy, 410
- Polzberg, 534
- Pomacanthus*, 393
- Pomacentridae*, 651
- Pomadasyis*, 650
- Pomatominæ*, 649
- Pomatomus*, 498, 572, 649; habits, 499; migrations, 516; spawning, 577; skull, 593
- Pomerania, 462
- Pomfret — see *Brama*
- Pomolobus*, 507, 515, **627, 628**
- Pomotis*, 410, 415
- Pomoxys*, 373, 556; *P. annularis*, 516, 564
- Pompano — see *Trachynotus*
- Pond culture, 560 f.
- Pondicherry Beds, 537
- Ponta Delgada, 518
- Ponte, 540
- Ponte Nuovo, 539
- Pontine marshes, 448
- Pontpierre, 535
- Poopó, Lake, 433
- Popular works, 495
- Porbeagle Shark — see *Lamna*
- Porcupine Fishes — see *Diodontidae*
- Pori abdominales*, 361, 608
- Porichthys*, 513, 514, 579
- Poronotus*, 543
- Port Arthur, 436
- Port Beira, 421
- Port-de-Bouc, 562, 566
- Port Castries, 431
- Port Erin, 469
- Port Jackson, 454
- Port Jackson Shark — see *Heterodontus*
- Port-Vendres, 483
- Portheus*, 626
- Portishead, 532
- Portland, England, 535
- Porto Bello, N. Z., 470
- Porto Rico, 431, 479
- Portugal, fauna, 396, 449, 450; fisheries, 474, **486**; museums, 518; palæontology, 531, 536, 538, 539; pisciculture, 568; vernacular names, 600
- Posen, 484
- Post-Branchial Body**, 574
- Potamotrygon*, 368
- Potomac R., 464; fisheries, 474, 478; shad hatching, 569
- Pound nets, 463
- Poverty Bay, 457
- Powrie Collection, 518
- Pre-branchial appendages, 584
- Pre-Linnæan Section**, 204 f.
- Pre-mandibular arches, 613
- Pre-sternum, 550
- Predatory Fishes**, 574, 575
- Pregnancy — see Reproduction, 575 f.
- Premnas*, 395
- Prenatal knob, 580
- Preservation, 392, 468, 469
- Pressure perception, 511
- Prevertebral region, 591
- Priacanthinae*, 649
- Pribilof Is., 424
- Primitive streak, 412, 413
- Prince Edward I., 425, 476
- "Princesse Alice," 396
- Prionodon*, 618
- Prionotus*, 461, 512, 596; taxonomy, 659
- Pristidae*, 593, 620
- Pristiophoridae*, 620
- Pristiophorus*, anatomy, 368; brain, 385; "saw," 500; viviparity, 581; visceral skeleton, 612
- Pristipoma*, 650
- Pristipomatidae*, 650
- Pristis*, 498, 552, 620; "saw," 398, 500, 574; viviparity, 581
- Pristiurus*, abdominal pores, 362; embryology, 409, 413, 414; nervous system, 522; reproduction, 580; spinal cord, 596; excretory organs, 608
- Processus digitiformis*, 366
- Processus falciformis*, 613
- Proctostegus* — see *Luvarus*
- Prolapsus recti*, 603
- Pronephros*, 598, 599, 606, **607, 608, 609**
- Proprius*, 620
- Propterygia*, 461, **603, 620**
- Prosencephalon, 385
- Protamines, 595
- Protandry, 503
- Protease, 403

- Protein, 528, 595
Proteocephalus (parasite), 546
Prothymallus, 628
 Protocercy, 459
 Protometameric skull, 591
 Protoplasm, 410
Protopterus, **625**; abdominal pores, 362; aestivation, 363; lung, 364; alimentary canal, 366, 367; anatomy, 368; in aquaria, 373; blood, 383; brain, 385; dentition, 398; scales, 402; embryology, 411, 414; eye, 418; fins, 461, 575, 603; heart, 502, 503; epidermis, 510; muscles, 520; nervous system, 522, 523, 524, 526; pancreas, 543; parasites, 545; pelvic girdle, 551; breeding habits, 576, 579; gills, 585; skull, 593; suprarenals, 598; urinogenital system, 607, 608; visceral skeleton, 612
Protosphyraena, 624
 Protospondyli, 612
Prototroctes, 410, 641
 Protozoan parasites, 548, 549
 Provence, 445
 Prussia, fauna, 446, 447; fisheries, 483, 484; palaeontology, 531, 535, 536, 537, 539, 540, 541; pisciculture, 567
 Pruth R., 439, 440
Prymnothonus, 642
Psammodontidae, 618
Psammosteidae, 663
Psammosteus, 401
Psephurus, 398, **623**
Psetta — see *Rhombus*
Psettus, 375
 Pseudamnion, 581
 Pseudo-copulation, 576, 577
 Pseudo-sternum, 550, 551
 Pseudobranchiae, 585
 Pseudobranchial arteries, 390
Pseudochalceus, 377
Pseudochromididae, 649
Pseudocorynopoma, 377
Pseudolabrus, 651
Pseudoscaphirhynchus — see *Scaphirhynchus*
Pseudotriakis, 589, 618
Pseudoxiphophorus, 377
 Psorosperms (parasites), 549
Psychrolutes, 658
Pteraspidae, 401, **663**
Pteraspis, 401, **663**
Pterichthys, 664
Pterois, 573
Pterolebias, 643
Pterophryne, 393, 577, 596, **661**
Pterophyllum, 374, 587
Pteroplatea, 581
Pterycombus, 653
 Pterygiophores, 457, 458
Ptychochromis, 587, 651
Ptychodus, 621
Ptyctodontidae, 621
Ptyctodus, 621
 Pütter's theory of nutrition, 551
 Puffer Fishes — see *Tetrodontidae*
 Puffin I., 469
 Pug-head, 604
 Puget Sound, 430, 479
 Punta Arenas, 431
 Pupil, 419
 Purbeck formation, 535
 Purge-fish — see *Rurettus*
 Purine, 528, 595
Purpura cyprinorum, 548
 Purring Gourami — see *Ctenops*
 Purse seine, 463
 Puteaux, 539
 Putrefaction, 469, 471
 Puy-en-Velay, 540
Pycnodontidae, 398, **623**
Pygidiidae, 546
Pygidium, 435
 Pygomely, 603
Pygosteus, 644
 Pyloric caeca, 366, 549, 603
 Pyramid Lake, 428
Pyrrhulina, 377, 634

 Quasr-el-Sagha Beds, 538
 Queen Charlotte I., 424
 Queensland, fauna, 454; fisheries, 488; fishing methods, 491; museum, 517; palaeontology, 538; pisciculture, 566, 570
 Quillan, 566

 Racalmuto, 541
Rachicentron — see *Rhachicentron*
 Racine R., 516
 Radials, 417, 458, 461
 Radiation — see Luminosity
 Radiographs, 601
 Radium, 409, 410, 553, 595
 Radoboj, 541
 Raffles Mus., 517
 "Rafts" of eggs, 571
 "Rag-fishes" — see *Icos-tidae*
 Ragusa, 541
Raia, 366, 394, 461, 492, 520, 584, **620**; anatomy, 368; circulatory system, 390, 391, 392; sex, 398, 504, 586; electricity, 406, 407; embryology, 409 f.; larval forms, 459; fins, 460; nerves, 522, 524; ova, 528; reproduction, 580; suprarenals, 599; teratology, 602, 603, 607, 608; thymus glands, 605; notochord, 611; visceral skeleton, 612
Raiatea, 457
 Raibl, 534
Raidae, 620
Rains of Fishes, 575
 Rameswaram I., 436
 Rámri I., 539
 Rangoon, 436, 542
Raniceps, 572, 647
Ranzania, 370, **622**
 Rappahannock R., 479
 Rarotonga, 456
Rashora, 378, 576, 587
Rashorichthys, 378
 Rathke's pocket, 387
 Rathlin I., 443
 Ratisbon, 536, 537
 Rattles, 488
 Ravenna, 518
 Rays — see *Batoidei*
 Recapitulation, 413, 415 f.
 Recessus orbitalis, 419
 Rectum, 366, 603
 Rectus abdominis muscle, 521
 "Red cod," 469
 Red corpuscles, 383
 Red Crag, 542
 Red-eye — see *Leuciscus*
 Red glands, 363
 Red Orfe, 564
 Red R., 427
 Red Sea, fauna, 405, 421, 423; fisheries, 475
 Red Snapper — see *Lutianus*
 Refrigeration, 469
 Refuse, pollution by, 464
Regalecus, **660**; intestine, 366; anatomy, 369; parasites, 543; skeleton, 590; skull, 593; as sea serpent, 660
Regeneration, 401, 412, 510, **575**
 "Reindeer period," 379
 Reissner's fiber, 524
 Religion — see Theology
Remora, **657**; adhesive disk, 362; symbiosis, 395; fins, 459; use in fishing, 490; size, 498; shipholder myth, 521; parasites, 544
 Renaissance literature, 505
 Renal mycosis, 547
 Renal organs, 391, 598, 606, 607
 Repositorium Valentini-anum, 518
Reproduction, 575-582; copulation, 400, 401, 576, 577, **580, 581**; viviparity, 409, 506, 595, **580-582**; breeding and spawning, 496, 497, 515, **577, 578**; oviparity, 506, **580, 595**; reproductive elements, 528, 595, 596; parental care, 578-580; ovoviviparity, 580; taxonomic value, 599; reproductive organs, 603, 604, **606, 607, 609**

- Respiration**, 509, 553, 582-584, 601
Respiratory Organs, 384, 510, 521, 584, 585; labyrinthiform organs, 385
 Restigouche R., 569
 Resuscitation, 602
 Rethel, 537, 539
 Retia mirabilia, 363, 385, 390
 Reticular tissues, 587, 588
 Retina, 419 — see also Eye
 Retournemer, 566
Retroclus, 651
 Réunion I., 437, 557
 Reuss R., 452, 569
 Reval, 450, 516
 Revilla Gigedo Is., 432
 Reynivellir, 567
 Rhabdocoels (parasites), 545
Rhabdofario, 628
Rhachicentridæ, 652
Rhachicentron, 652
Rhadinichthys, 380
Rhætics, 534, 535
Rhamdia, 378
Rhamphichthys, 378
 Rheims, 539
 Rheotaxis, 382
 Rheotropism, 382, 595, 613
Rhina, 581, 608
 Rhine R., 464, 516; fauna, 446, 447; fisheries, 483; pisciculture, 566
Rhinelepis, 369
Rhineodon, 619; dentition, 398; food of, 492; size, 498; habits, 499; branchial arches, 613
Rhinichthys, 378, 579
Rhinidæ, 362
Rhinobatidæ, 620
Rhinobatus, 581
Rhinodontidæ, 619
Rhinoptera, 582, 602
Rhizodontidæ, 622
 Rhode Island, 469, 516; fauna, 430; fisheries, 479; pisciculture, 569
 Rhodesia, 423
Rhodeus, 636; in aquaria, 378; hybrid of, 506; incubation, 578; alleged viviparity, 582; vertebral column, 612
 Rhomboidal plates, 402
Rhomboidichthys, 587; eggs and larvæ, 654
Rhombus, 393, 494, 527, 653, 654; hybrids, 506; culture, 562, 566; eye, 655
 Rhône R., 445, 483, 548
Rhynchostomidæ (parasites), 545
Rhypticus, 649
 Riacho Doce, 539
Ribs of Fishes, 585, 586; origin, 417; association with sternum, 551; homologies, 591
 Richardson Lake, 428
 Richmond, 538
 Riechelsdorf, 534
 Riga, Gulf of, 450
 Rigidity, 512
 Rikitea, 456
 Rio del Altar, 432
 Rio Arasuahy, 433
 Rio Benito, 538
 Rio Blanco, 432
 Rio Cauca, 434
 Rio Cheneche, 434
 Rio Conchos, 432
 Rio Cubataõ, 434
 Rio Daule, 434
 Rio Esmeraldas, 434
 Rio Grande, 432
 Rio Grande do Sul, 434
 Rio Guayas, 434
 Rio Huallaga, 435
 Rio Iguasú, 433, 434
 Rio Iporanga, 434
 Rio Itapocú, 434
 Rio de Janeiro, 433, 434, 519
 Rio Jurua, 433
 Rio Lerma, 432
 Rio Maecurú, 531
 Rio Meta, 434, 435
 Rio Mucury, 433
 Rio Napo, 434
 Rio Negro, 433, 508
 Rio Oro, 540
 Rio Panuco, 432
 Rio Piracicaba, 434
 Rio de la Plata, 433, 516
 Rio Presidio, 432
 Rio Preto, 433
 Rio San Francisco, 434
 Rio Soto la Marina, 432
 Rio Tuy, 435
 Rio Ucayali, 435
 Rio Urubamba, 435
 Rio das Velhas, 433
 Rio Verde, 432
 Rio Vines, 434
 Rio Yaqui, 432
 Rio Xingu, 433
 Riou Linga Archip., 456
Rissola, 500
 Riu-Kiu Is., 438
 Riviera (Italian), 516
Rivulus, 377, 643
 Roach — see *Leuciscus*
 Roanoke R., 569
 Roath Park hatchery, 565
Roccus, 371, 507, 604, 649; embryology, 415; culture, 558, 559, 563, 569
 Rock Bass — see *Ambloplites*
 Rockfish — see *Sebastodes*
 Rockhampton, 454
 Rockling — see *Motella*
 Rockmills hatchery, 565
 Rodriguez I., 437
 Rods, 488, 498
 Roe — see Ova and Ovum
Ræboides, 378
 Römhild, 535
 Röntgen rays, 601
 "Röthel" — see *Salvelinus*
 "Rogue," 473, 488
 Rogue R., 569
 Rohon-Beard cells, 596
 "Rolled roe," 574
 Rolling Downs formation, 538
 Romans (ancient), 488, 504, 505, 514, 521, 605; fisheries, 462; pisciculture, 554, 567
 Rome, 463, 518
Rondeletiidae, 642
 Roosen process, 468
 Rosans, 537
 Rosario, 432
 Rosefish — see *Sebastes*
 Rosignano, 541
 Rostock, 531
 Rotator, 554
 "Rote Beulenkrankheit," 547
 "Rotseuche," 548
 Rotti I., 456
 Rouergue, 444
 Rouffach, 540
 Roumania — see Rumania
 Roundworms, 544, 546
 Rudd — see *Leuciscus*
 Rudolf, Lake, 421
 Rüdersdorf, 535
 Rügen I., 446, 484
 Ruhr R., 464
 Rukwa Lake, 421
 Rumania, 450, 486, 539, 540
 Rumination, 492
 Rumpf Collection, 518
 Rupelian stage, 540
 Russia, 464, 507, 516, 548; fauna, 438, 439, 450; fisheries, 467, 470, 473, 474, 486, 487; museums, 518, 519; palæontology, 531, 532, 533, 534, 536, 538, 540, 541; pisciculture, 563, 568
 Russian Central Asia, 438
 Russian method of fertilization, 555
 Russian R., 426
Rutilus, 389, 504, 505, 506; taxonomy, 636
Ruvettus, oil of, 466, 514; habits, 499; skull, 593; mode of capture, 652
 Rye, 442
 Saalfeld, 542
Saccobranchus, 370, 378, 585
Saccopharyngidæ, 641
Sacculus endolymphaticus, 380
Saccus paravertebralis, 391
Saccus vasculosus, 387
 Sacramento R., 426, 464, 473, 474, 558
 "Saftkanälchen," 389
 Saginaw Bay, 428
 Sagittiform structure, 362, 493
 Saguenay R., 425

- Sahara Desert, artesian well fauna, 406, **423**; palæontology, 536, 540
 Saibling — see *Salvelinus*
 Sailfishes — see *Histiophoridae*
 Saint-Amand, 536
 St. Andrews, 443, 469
 St. Bartholomew I., 431
 St. Cassian Beds, 534
 St. Catherine, 425
 St. Christopher I., 431
 St. Clair Lake, 428
 St. Clair R., 563
 St. Croix, Virgin Is., 431
 St. Eustatius I., 431
 St. George's Bank, 424, 425; cod fisheries, 476
 Saint-Grout, Lac, 566
 Saint-Jean Lake, 425
 St. John R., Canada, 424
 St. John's R., Florida, 426, 478
 St. Just, 539
 St. Helena I., 420
 St. Lawrence Reservation, N. Y., 569
 St. Lawrence R., 425, 476
 St. Louis, 466, 569
 St. Lucia, 431
 St. Margaret's Bay, 425
 St. Martin I., 431
 St. Paul I., 437
 St. Paul's R., 422
 St. Petersburg, 450, 463, 467; museums, 518
 St. Pierre I., 424
 St. Thomas I., 422
 St. Thomas I., Virgin Is., 431
 Saint - Vaast - La - Hougue, 445, 470, 562, 566
 St. Valéry-sur-Somme, 562
 St. Vincent, 431
 St. Vincent's Gulf, 453
 Sakhalin I., 439, 480
 Salanginae, 633
 Salinity of water, 552
 Salivary glands, 365
 Salmine, 595
Salmo, **628-630**; brain, 385; skin, 509, 510; supracrenals, 598; visceral skeleton, 612 — see also *Salmon*, and *Trout*
 Salmon, 516, 575, 606, **629**, **630**, 631, 632; fins, 461; as food, 465; fisheries, **473**, 476, 478, 479; nervous system, 522; pancreas, 542; parasites, 543; culture, 552, 554; sex-ratio, 586; skeleton, 589; spleen, 595, 597; Atlantic Salmon, 629; Pacific Salmon, 630, 631; reproduction, **630**, 631, 632; migrations, 631
 Salmonidae, **628-634**; abdominal pores, 361; anatomy, 369; angling, 371, 443; blood, 383; color, 388, 394, 551; muscles, 388, 519, 520; circulation, 389; dentition, 399; embryology, 410, 411, 413, 529, **628**; fins, 458, 461; culture, 464, 505, 555, **562**, 565, 566, 567, 568, 569; growth, 496, 497; heart, 502; hermaphroditism, 504; hybrids, 506, 507; diseases, 547, 548; introduction, 557, 558, 570; skull, **592**, 594; teratology, 603, 604; reproduction, 609, 610, 631, **632**; vertebral column, 612; distribution, 628; fossil forms, 628; taxonomy, 628
 Salmoninae, 628-632
 Salmoperca — see *Percopsidae*, 590, 643
 Salt Lake, 569
 Salt lakes, 406
 Salt Range, India, 533
 Salting fish, 469, 471
 Salvador, 432
Salvelinus, **631**; hybrids, 507; introduction, 558 — see also *Trout*
 Salzach R., 440
 Salzburg, 440, 517, 534, 565
 Samland, 539
 Samlet, 629
 Samoan Is., fauna, 456; fisheries, 488; vernacular names, 600
 San Diego, 426, 469, 576
 San Francisco, 426, 468, 558
 San Giovanni, 542
 San Ignacio, 432
 San Joaquin R., 426
 San Juan Is., 430
 San Juan R., 434
 San Marcos, 569
 San Marino, 541
 Sand-darter — see *Ammocrypta*
 Sand-eel — see *Ammodytes*
 Sandalwood I., 456
 Sander — see *Lucioperca*
 Sandfort, 567
 Sandwich Is., 454 — see also Hawaiian Is.
 Sangir Is., 456
Sanguinicola (parasite), 545
 Sankuru R., 422
 Santa-Ana R., 426
 Santa Barbara I., 426
 Santa Catalina I., 426
 Santa Catharina I., 433, 434
 Santa Cruz, 431
 Santiago, 519
 Santo Domingo, 431, 538
 São Paulo, 434, 538
 Saona I., 431
 Saparua I., 455
 Sapayo, 434
Sapindus (poisonous plant), 489
Saprolegnia (fungus), 548, 550
 Sarajevo, 538
 Saratov, 451, 470
Sarcodaces, 362, 579
Sarda — see *Gymnosarda*
 Sardine, 404, 547, **627**; embryology, 415; fisheries, **473**, **474**, 488, 602; bait, 473; food, 493; ova and larvæ, 572; spawning, 577; adult form — see *Clupea pilchardus*
 Sardinia, 451, 485, 540, 541
 Sargassum-fish — see *Pterophryne*
 Sargassum weed, 579
Sargus, 375, 397, 504, 604, 650
 Sarkine, 595
 Sarnensee, 453, 487
 Sary-su R., 438
 Saucats, 541
 Sauer R., 448
Saurenhelys, 369
Sauripterus, 550
Saurodontidae, 626
 Saurus, 415
 Savi's vesicle, 511
 "Saw," 398, 500, 574
 Sawdust pollution, 464
 Sawfishes — see *Pristiophorus* and *Pristis*
 Scabbardfish — see *Trichiurus*
 Scales, 398, 399, **400 f.**, 458, 461; guanin, 465; age determined by, 496, 497; lateral line, 524; fossil, 543; diseases of, 548; regeneration, 575; abnormal, 602; variation, 610
 Scandinavia, 508 — see also Denmark, Norway, and Sweden
Scapanorhynchus — see *Mitsukurina*, 385, **619**
Scaphaspis, 663 — see also *Cyathaspis*
Scaphirhynchus, 369, 461, 551, **623**
 Scapulæ, 496, 550
 Scarborough, 442, 481
Scardinius, 503, 506
Scardinopsis, 506
 Scaridae, 399, **651**
Scarus, rumination, 365, 492; frontal gibbosity, 587
Scatophagus, 373, 650
 Scaumenac Bay, 531
Schedophilus, 646
Schizothorax, 365, 510
 Schleswig-Holstein, 446, 447, 484, 567
 Schleusingen, 567
 Schleweke, 539
 Schlotheim, 535
 Schoodic Lakes, 427
 Schools, fisheries, 462
 "Schuppensträubung," 548

- Schuykill Fishing Company, 479
 Schuykill R., 429
Sciæna, 369
Sciænidæ, 364, 402, 595; taxonomy, **649**
 Scilly Is., 441, 481, 516
 Scio I., 439
 Sclera, 420
 Scleroblast, 458, 588
 Sclerodermi, 402, **661**, 662
Sclerognathus, 604
 Scleromeres, 591
Scleropages, 369, 580
Scleroparei, **657-659**; anatomy, 369; embryology, 415; habits, 499; ova and larvæ, 572; skeleton, 590
 Sclerotomes, 591
Scoliodon, 581
Scolopsis, 650
Scomber, 499, 595, **652**; eye, 418; fisheries, 472; food of, 492, 493; growth and age, 497; head, 500; hermaphroditism, 504; migrations, 516; nerves, 524, 526; ova and larvæ, 572; skull, 593; variation, 610
Scomberomorus, fisheries, 472, **652**; culture, 563, 570; taxonomy, 652
Scombresocidæ, 362, 582, **645**
Scombresor, 572
Scombridæ, 590, 647, **652**
Scombriformes, **651-653**; anatomy, 369; embryology, 415; habits, 499; ova and larvæ, 572; skeleton, 590; taxonomy, 651
Scombrocottus — see *Anoplopoma*, 658
Scombron, 595
Scopelidæ, 401, **642**; ova and larvæ, 571, 572
Scopelus, luminosity, 513, 514; skull, 593; taxonomy and distribution, 642; larval form — see *Stylophthalmoides*
Scorpæna, 658
Scorpænichthys, 391
Scorpænidæ, 405, 582, **657-658**; poison apparatus, 573
 Scorpionfish — see *Scorpæna*
 Scotland, 498, 507, 548, 603; Scottish-Norwegian land bridge, 405, 443; fauna, 443; fisheries, 463, 467, 468, 469, 471, 472, 473, 474, **481, 482**; palæontology, 531, 532; pisciculture, 565; plankton surveys, 571
 Sculpins — see *Cottidæ*
 Scup — see *Stenotomus*
Scylliidæ, 618
Scylliorhininæ, 618
Scyllium, 362, 403, 499; intestine, 366; blood, 383; brain, 385, 387, 388; circulatory system, 389, 390, 391; embryology, 389, 411, 413, 414; in aquarium, 409; hermaphroditism, 504; nerves, 523, 524, 525; ova, 528; reproduction, 577, 604; suprarenals, 598
Scymnus, 385, 414, 523, 581, 608, 620
 Sea Bass — see *Centropristis*
 Sea-horse — see *Hippocampus*
 Sea Robin — see *Prionotus*
 Sea-serpent, 521, 660
 Sea Snail — see *Liparis*
 Seals — see *Heraldry*, 521
 Seba Museum, 518
Sebastes, 529, 582, 609, **658**
Sebastodes, 593, 658
Sebastolobus, 590
 Secretory organs, 388, 509, 510, 578, 597
 Seeborg, 447
 Seefeld, 534
 Segmental duct — see *Pro-nephros*
 Segmentation, **410**; skeletal, 591; skull, 591; segmental bodies, 597; suprarenals, 598; meristic variation, 610; cartilaginous, 611
 Seifhennersdorf, 540
 Seine R., 445, 554
 Seines, 463
Selache — see *Cetorhinus*
Selachii, **617-620**; abdominal pores, 361; air-bladder, 363; adenoid organ, 365; intestine, 366; anatomy, 368; blood, 383; brain, 385; circulation, 389, 390, 391; distribution, 405, **617**; embryology, 410, 411, 412, 414, 581; eye, 418, 419; tail, 459, 460; fins, 460, 461; habits, 499; head, 500; heart, 502, 503; hermaphroditism, 504; fossil forms, 508, **617**; skin, 510; lateral line, 511; liver, 512, 580; luminous organs, 514; museum exhibits, 518, 519; muscles, 520; nerves, 522, 523, 525, 526; olfactory organs, 527; ova, 528; pathology, 547; physiology, 553; reproduction, 577; gills, 585, 613; skeleton, 588; skull, 591, 592, 593; spermatogenesis, 596; spinal cord, 596; spleen, 596, 597; thymus glands, 605; thyroid gland, 606; urinogenital system, 607, 608; vertebral column, 611; visceral skeleton, 612; taxonomy, 617
 Selborne, 441
 Selection, 415
Selene, 375
Selenichthyes, 644
 Semaio I., 456
 Sembach, 567
 Semicircular canals, 380, 501
Semicossyphus, 587
 Seminal vesicles, 609
Semionotidæ, 623
Semionotus, 623
Semotilus, 576, 579, 636
 Sempacher See, 453, 487
 Senckenberg, 518
 Sendenhorst, 537
 Seneca Creek, 428
 Senegal, fauna, 423; fisheries, 475; palæontology, 538
 Senigallia, 541
 Senonian series, 537
Senses and Sense Organs, 511, 522, **586**; in deep-sea fishes, 396; hearing, 501, 502; smell, 594; taste, 599; touch, 599; vision, 613, 614
 Septicæmia, 548
 Serbia, 451, 490
 Sergipe, 537
Seriola, 395
 Serosporidia (parasites), 549
 Serotherapy, 573
 Serous envelope, 366
 "Serpent's eyes," 399
Serranidæ, **648**; in aquaria, 375; scales, 402
Serraninæ, 648, 649
Serranus, 410, 415, 503, **649**
Serrasalmo, in aquaria, 377; attacking men, 574
Serrasalmoninæ, 634
Serrulæ, 584
 Sertoli-cells, 595
 Serum, 384
 Sesamoid articular, 592
 Settenz, 531
 Severn R., 441
 Sevilla, 519
 Sex, sexual products, 361, 595, 596; maturity, 362, 577, 587; differences, 398; determination, 409, 410, 586; hermaphroditism, 503, 504; of hybrids, 505, 506, 507; fish as symbol of, 521
Sex-Ratio, 586
Sexual Dimorphism, 461, **586, 587**
 Seychelles Is., 437
 Seymour I., 538
 Seyssel, 535, 536

- s'Gravenhage — see The Hague, 467, 468
 Shaalsee, 567
 Shad, Allis — see *Clupea alosa*; American — see *Alosa sapidissima*; Twait — see *Clupea finta*
 Shagreen — see Dermal Skeleton
 Shakespeare, fishes in, 504
 Shanghai, 436
 Shari R., 421
 Shark-suckers — see *Echeneis* and *Remora*
 Sharks — see Plagiostomi, also Selachii
 Sharp-nosed Shark — see *Scoliodon*
 Sheppy, Isle of, 539
 Shetland Is., 444, 482
 Shikoku I., 438
 Shipholder myth, 521
 Shipping cases, 554
 Shock machines, 514
 Siam, 438, 480
 Siberia, fauna, 438; fisheries, 473, 474, **480**; museums, 517; palæontology, 542
 Sicily, 516; fauna, 451; fisheries, 474, 485; palæontology, 531, 534, 535, 540, 541; pisciculture, 567; vernacular names, 600
Sicydium, 499, 657
 Siegsdorf, 540
 Sierra-Leone, 423
 Sierra Nevada Mts., 493, 557
 Sig R., 558
 Silesia, 440, 447
 Sillaginidæ, 649
 Silurian fossil fishes, 398, **531**, 663, 664
 Siluridæ, 458, 510, 550, **636**, **637**; air-bladder, 364; anatomy, 369; in aquaria, 378; auditory organs, 381; fossil forms, 388, 636; habits, 499; lateral line, 511; nerves, 524, 525; parasitic, 546; culture, 556, 561; poison apparatus, 573; barbels, 575, 602; reproduction, 576, 580, 582; respiration, 583; skeleton, 589; skull, 592, 594; sound, 595; tactile organs, 599; urinogenital appendages, 606 f.
 Silurinæ, 636
Silurus, 490, 509, 603, **636**; stomach, 365; anatomy, 370; in aquaria, 378; color, 394; electricity, 408; eye, 418; muscles, 520; nerves, 526; introduction, 556; pseudocopulation, 576; gills, 585
 Silver Lake, 429
 Silverside — see *Menidia*
 Silvery coloration, 393
 Simbirsk, 451
 Simenchelyidæ, 589
 Simla, 436
 Sinaloa, 432
 Sind, 436
 Singapore, 456, 517
 Sinus terminalis, 389
 Sinus urogenitalis, 362, 391, 609
 Sinus venosus, 503
Siphonostoma, 375, 610
Siphostoma, 411, 415
 Sitang R., 436
 Siwaliks, 542
 Size, 497, 498, 642 — see also Growth
 Skaaren Is., 444
 Skager Rack, 444, 572
 Skåne, 452, 538
 Skates — see *Raiidæ*
 Skawina R., 480
Skeleton, 459, 460, 461, 493, 518, **587-590**, 601, 612; dermal, 399 f.; skull, 590-594; vertebral column, 610, 612; visceral, 612, 613
 Skin — see Integument
Skull, 368, 416, 418, 550, 589, **590-594**, 612; abnormalities, 604
 Skye, Isle of, 443
 Slavonia, 439
 Slawanka, 532
Sleep, **594**; æstivation, 363; hibernation, 504
 Sleeper Shark — see *Læmargus*
 Slime, 509
 Slime cel — see *Myxine*
 Small-mouth Black Bass — see *Micropterus*
Smaris, 504, 587; as white-bait, 474
Smell, 382, **594**; olfactory organs, 386, 525, **527**
 Smelt — see *Osmerus*
 Smith Sound, 425
 Smithsonian Institution, 466, 519
 Smoking fish, 468
 Smolt, 629, 630
 Snapper — see *Lutjanus*
 Snout — see Head, 500
 Snow Hill I., 538
 Societies, fishery and piscicultural, 462 f., 565, 567, 568
 Society Is., 457
 Soke (fish poison), 489
 Sokotra I., 437
Solea, **654**, **657**; œsophagus, 365; coloration, 393, 394, 654; eggs and larvæ, 461, 654; fisheries, 471; food of, 493; culture, 559, 562, 570; spawning, 577; spinal cord, 596; reproduction, 609; vertebræ, 611; fossil forms, 657
 Soleinæ, 657
 Solenhofen, 536
Solenostoma, 415
 Solenostomidæ, 369, 578
 Solomon Is., 456, 489
 Solor I., 456
 Solway Firth, 444
 Somactidia, 417
 Somaliland, 423
 Somites, 591, 607
 Somkele, 532
Somniosus — see *Læmargus*
 Song of fishes, 594, 595
 Sonora, 432
Sound, 501, **594**, **595**
 South Africa, 516, 571
 South America, 405, 508, 516; fishing methods, 372, 490, 491; fauna, 377, **432-435**, 491, 546, 580, 595; fisheries, 479; museums, 519; palæontology, 533, 537, 538, 539, 540, 542; fishes introduced, 556, 557, 558; pisciculture, 570
 South Carolina, fauna, 430; fisheries, 479; palæontology, 538, 540; pisciculture, 563
 South Dakota, fauna, 430; palæontology, 535, 537, 540
 South Ferriby, 537
 South Georgia Is., 240
 South Hadley Falls, 562, 563
 South I., N. Z., 457
 South Park, Colorado, 538
 South Seas, 464, 466, 508; fishing methods, 489, 490, **491**; islands — see *Oceanica*, 453 f.
 South Trinidad I., 420
 Southwater, 535
 Spain, 493, 528; fauna, 451, 452; fisheries, 471, 473, 474, **487**; museums, 519; palæontology, 536, 540, 541; pisciculture, 568
 Spanish Mackerel — see *Scomberomorus*
 Sparidæ, 418, 503, **650**
 Sparoidea, 593
Sparus, 603, 609, 650; ova and larvæ, 529, 572
 Spawning, 577
 Species, origin of, 416; variation, 610
 "Speedwell," 477
 Spermatogenesis, 595
 Spermatophores, 595
Spermatozoa, 361, 391, 410, 503, 504, 505, **595**, **596**, 607, 608; effect of radium on, 410; permeability of egg membrane, 528
 Sphenethmoid bone, 593
 Sphenoid region, 593

- Sphenotic bone, 592
Spheroides, 402, 403, 574, 594
Sphyræna, 395, 574, **645**
Sphyrænidæ, 589, **645**
Sphyriidæ (parasites), 543
Sphyrna, 413, 498; viviparity, 581
 Spice Is., 455
 Spiders, spider-web lure, 488; spider-web nets, 489; killing fishes, 559
Spinachia, 644
Spinacidæ, 514, 619, 620
 Spinal column, 610 — see also Vertebral Column
Spinal Cord, 407, 522, **596**; spinal meninges, 391; spinal nerves, 525, 526, 591
Spinax, abdominal pores, 362; anatomy, 368; head, 500; lateral line, 511; luminosity, 513; nerves, 524; prenatal knob, 580; sensory organs, 586; sex-ratio, 586; thymus glands, 605; reproductive and excretory organs, 608
 Spines, 402, 511, 586; fin, 458; poisonous, 573; stridulation, 594
 Spinney Hills, 534
 Spiny Sharks — see *Spinacidæ*
 Spiracles, **584**, 605
 Spiral valve, **366**, 367, 390, 391, 603
Spirochætes (parasites), 469, 549
 Spitzbergen, fauna, 452; palæontology, 532, 535, 538
 Splanchnic arteries, 390
 Splanchnocœle, 585, 610
Spleen, 383, 388, 403, 547, **596**, **597**; parasites, 548, 549
 Spoonbill — see *Polyodon*
 "Spoonbill sturgeon," 474
 Sporozoa (parasites), 548, 549
 Spotted Sting Ray — see *Aetobatus*
 Sprat — see *Clupea sprattus*
 Spree R., 516
 Spurge (fish poison), 489
Squalidæ, 368, **620**
Squalius, 378, 385
Squalonchocotyle (parasite), 545
Squaloraia, 401, 511, 586, **621**
Squaloraiidæ, 621
Squalus, circulatory system, 390; reproduction, 409, 580, 581; nervous system, 515, 522; physiology, 553; teratology, 602
 Squam Lake, 428
 Squamipinnes, 647
Squatina, 368, 552
 Squeteague — see *Cynoscion*
 Squirrel-fish — see *Holocentrum*
 "Staggers," 549
 Staining, 553; intra-vitam, 601
 Stampian fossil fishes, 540
 Stannius, corpuscles of, 597
 Staoueli, 536
 Stapes, 380
 Star-gazer — see *Uranoscopus*
 Starnberg, 462
 Starvation, effects of, 551
 Stassfurt, 535
 Static sense, **501**, **502**; function of brain, 387; function of membranous labyrinth, 501, 502
 Stations, fisheries, 462, 469, 470; piscicultural, 555, 565, 566, 567, 568, 569, 570
 Steamers, U. S. F. C., 476 — see also Voyages, **343**
 Steapsin, 403
Steatogenys, 407
 Steering mechanism, 512
Stegophilus, 546, **637**
Stegostoma, 528, 593
 Steinbiedersdorf, 535
 Steinheim, 541
Stenotomus, 593, 650
Stephania (poisonous plant), 489
Stephanoberycidæ, 643
Stereolepis, 498, 649
 Sterility, 506, 507
 Sterlet — see *Acipenser*
 Sternberg, 540
 Sternbergersee, 440
 Sternoptixinæ, 369
Sternoptychidæ, 514, 572, **633**
Sternoptyx, 418, 513
 Sternum, 550, 551
 Stettiner Haff, 446
Stichæus, 659
 Sticklebacks, 644 — see also *Gasterosteidæ*
Stigmatophora, 587
 Sting Rays — see *Trygonidæ*, 620
 Stingarees — see *Trygonidæ*
Stizostedion, 529, 548, 575, 593, **648**; embryology, 414, 415; food of, 493; culture, 559, 562; sexual dimorphism, 587
 Stockholm, 462, 519, 463
 Stockhornsee, 452
 Stocking — see Pisciculture
 Stomach, **365**, 366, 391, 403; contents, 491-493; gastroliths, 494; abnormal, 603
Stomias, 572
Stomiatidæ, 633
 Stomodæum, 397
 Stone Age, 444
 Stormontfield-on-Tay, 565
 Straining mechanism, 613
 Stratigraphy, 530
 Stratum corneum, 509
 Stratum of Malpighi, 509
 Stridulation, 594
 Striped Bass — see *Roccus*
Stromateidæ, 646
 Stuhlweissenburg, 466
 Sturgeon — see *Acipenser*
 Sturine, 595
Stygicola, blindness, 382; reproduction, 582, 609
Stylephoridæ, 661
Stylephorus, 661
Stylephorus — see *Stylephorus*
Stylophthalmoides, 572; adult forms — see *Scopelus*
 Styria, fauna, 440; fisheries, 480; palæontology, 540, 541
 Sub-Antarctic fishes, 405
 Sub-mental filaments, 407
 Sub-notochordal rod, 611
 Subclavian arteries, 390
 Subcommissural organs, 523
Subject Index, Morphological Section, **361** f.; Systematic Section, **615** f.
 Submucosa, 365
 Subpial layer, 596
 Succus entericus, 403
 Sucking disk — see Adhesive Disk, **362**, 510
 Sucking fishes — see *Echeneis* and *Remora*
 Sudan, 423, 528
Sudis, 583
 Suez Canal, 405, 423
 Suffocation, 584
 Sugar solutions, 553
 Suir R., 442
 Sulu, 490
 Sumatra, 516; fauna, 456; fisheries, 488; fishing methods, 490; palæontology, 538
 Sumba I., 456
 Sumbawa I., 456
 Sunapee Lake, 428, 507, 557
 Sunda Is., 456
 Sunfish — see *Eupomotis* and *Lepomis*; Ocean Sun-fish — see *Orthogoriscus*
 Superanal gland, 366
 Superfoetation, 506
 Superior, Lake, 425, 476
 Supracarinales, 521
 Supraclaviculæ, 586
 Supracleithralia, 550
 Suprapericardial body — see Post-Branchial body
Suprarenal Organs, 390, **597-599**
 Sura R., 451
 Surf Fishes — see *Embiotocidæ*
 Surf Smelt — see *Hypomesus*
 Surrenal — see Suprarenal
 Surveys, plankton, **571**, 572

- Suspensorium, 592
 Susquehanna R., fauna, 429, 430; fisheries, 474, 479; salmon introduced, 557
 Sutton Coldfield Park, 442
 Suvarof I., 457
 Swale R., 465
 Swallower — see *Chiasmodon*
 Swammerdam Coll., 518
 Swan Is., 431
 Swanage, 535
 Swansea Bay, 444
 Swat, 436
 Swatow, 436
 Sweden, 515; fauna, 405, **452**, 498; fisheries, 462, 467, 470, 471, 472, 473, **487**; fishing methods, 488, 490; museums, 519; palæontology, 531, 538, 540, 542; pisciculture, 556, 557, 558, 559, 562, **568**; vernacular names, 600
 Swim-bladder — see Air-bladder
 Swimming, 512; respiration as factor, 581
 Switzerland, 464, 485, 493, 516, 543, 548; fauna, 405, 452; fisheries, 467, 473, 474, **487**, **488**; museums, 519; palæontology, 535, 536; pisciculture, 557, 558, 564, **568**, **569**
 Swordfish — see *Xiphias*
 Sydney, 454
Symbiosis, 394 f.
Symbolism, 521
 Symbranchidæ, 637
 Symbranchii, 415, 588, 637
Symbranchus, 379, 415, 603
 Symmetry, 494
 Sympathetic ganglia, 597, 598
Synagris, 650
Synancia, 573, 658
 Synaphobranchidæ, 589, 641
 Syngnathidæ, **644**, 645; anatomy, 369; in aquaria, 375; embryology, 415
Syngnathus, 395, 402, 493, 528, 552, 575, 603; æsophagus, 365; anatomy, 369; in aquaria, 375; embryology, 415; habits, 499; locomotion, 512; nerves, 525; pectoral girdle, 550; metamorphosis of larvæ, 571; reproduction, 578; respiration, 583, 585; sex, 586, 587; skeleton, 589; skull, 594; urinogenital appendages, 606; visceral skeleton, 612
 Synodontidæ, 642
Synodontis, 458, 509, 637
Synodus, 572, 642
 Syr Daria R., 438
 Syria, fauna, 439, 580; fisheries, 480; palæontology, 537
 Systema Naturæ, 600
 Szerem, 542
 Taboo, 521
Tactile Organs, 388, **599**
 Tadpole-fish — see *Raniceps*
 Tadpole stage, 415
 Tæniosomi, 369, 572, **660**, **661**
Tæniura, 552
 Tagging, 516 — see also Migrations
 Tagus R., 449
 Tahiti, 457
 Tahoe, Lake, 426
 Tail, 459
 Talbragar Beds, 536
 "Talisman," 396
 Talmud, fishes in, 605
 Tamaulipas, 432
 Tampa, 478
 Tananarivo, 556
 Tanega I., 438
 Tang — see *Teuthis*
 Tanganyika, Lake, 423
 Tapetum lucidum, 419
 Tapeworms, 545, 546
 Taranaki coast, 457
 Tarbert Laboratory, 482
 Tarnócz, 539
 Tarpon — see *Megalops*
 Tarpum — see *Megalops*
 Tasmania, fauna, 397, 454; fisheries, 488; palæontology, 535; fishes introduced, 557, 558
Taste, **599**; organs of, 388; buds, **498**; nerve of, 525
 Tatihou I., 445, 470, 562
 Taubaté, 538
 "Taumelkrankheit," 547
 Taunus, 567
 Tay R., 443
 Taxidermy, 392
Taxonomy, 398, 399, **599**, **600**; based on teeth, 398; based on scales, 399; based on osteology, 590; based on cranial characters, 593
Technique and Methods, **600**, **601**
 Tectum opticum, 387, 524
 Teeth — see Dentition
 Tegelen-sur-Meuse, 542
 Tehautepec I., 432
 Tela subcutanea, 510
 Telencephalon, 385, 386, 526, 593
 Teleneurones, 523
 Teleosporidia (parasites), 548
 Teleostei, **625** f.; intestine, 366; anatomy, 369; in aquaria, 373 f.; auditory organs, 380; blood, 383 f.; brain, 385, 386, 387; circulation, 389, 390, 391, 392; dentition, 397, 398, 399; scales, 401, 402; embryology, 410, 411, 412, 413, 414; eye, 418, 419, 525, 614; fins, 458, **461**, 462; food, 492, 493; gustatory organs, 498; size, 498; habits, 499; heart, 502; sex, 503, 504, 587; hybrids, 505, 507; integument, 507–511; lateral line, 511; liver, 512; locomotion, 512; luminous organs, 514; migrations, 515, 516; myology, 519, 520; nerves, 522, 523, 524, 526, 527; olfactory organs, 527; ova and larvæ, 529, **571**, **572**; pancreas, 543; pectoral girdle, 550; regeneration, 575; reproduction, 577, 578, 580, 582, 595, 596, **609**, **610**; respiration, 584, 585; ribs, 585; skeleton, 588, **589**, **590**; skull, 592, **593**, **594**; spinal cord, 596; spleen, 597; suprarenals, 597, 598; teratology, 603, 604; thymus glands, 605; thyroid gland, 606; urinogenital system, 606, 607; vertebral column, 611, **612**; visceral skeleton, 612
 Teleostomi, **621** f.; abdominal pores, 361, **362**; dentition, 398; scales, 399; fins, 458, 460, **461**; nervous system, 527; respiratory organs, 584; ribs, 585; skeleton, 588, **589**, **590**; skull, 591, **593**, **594**; spinal cord, 596; suprarenals, 598; urinogenital system, 609; vertebral column, 611, **612**
 Teletskoi, Lake, 438
 Temiscaming, 425
Temperature Effects, **601**, **602**; on color, 393; on digestion, 403; on occurrence and movements, 406, 504, 552; on reproduction, 409, 410, 555, 595; on eye, 419; on fins, 458; on heart action, 502; on respiration, 583; on vertebræ, 611
Temperature of Fishes, 395, **602**
 Tenby, 444
 Tench — see *Tinca*
 Tendons, 520
 Tennant Coll., 517
 Tennessee, 430, 479
 Tennessee R., 425
 Tensor muscle, 614
 Tentacles, 599

- Tentaculum, 401
Tephrosia (poisonous plant), 490
Teratology, 504, 528, 596, 602, 603, 607; exhibit, 517
 Terminal buds, 586
 Terminal ganglion, 596
 Ternate I., 455
 "Terra d'Otranto," 542
 Terrain houiller de Commentry, 534
 Terrell Collection, 519
 Terrestrial progression, 512, 513
 Tertiary fossil fishes, 405, 538
 Tessellated Darter — see *Boleosoma*
 Testes, 390, 504, 607, 608, 609; ovotestes, 503
 Tet R., 445
 "Tête du chien," 604
Tetracotylus (parasite), 545, 546
Tetragonopterus, 377, 634
Tetragonuridae, 645, 646
Tetragonurus, 370, 645, 646
Tetramitus (parasite), 550
Tetraodon — see *Tetrodon*
Tetrapturus, 652
Tetrarhynchus (parasite), 546
Tetrodon, 403, 527, 662; in aquaria, 379; inflation, 500; poisonous properties, 574
Tetrodontidae, 363, 402, 662
Tetronarce, 407
Teuthis, 458, 550, 592, 650
 Texas, fauna, 406, 430; fisheries, 479; museums, 519; palæontology, 433, 537; pisciculture, 569
 Text-books, natural history and zoology, 494, 495; palæontology, 529 f.; physiology, 551
 Teyler, Musée, 518
 Thalamencephalon, 386
Thalassorhinus, 618
Thaleichthys, 465, 466, 633
Thalassophryne, poison apparatus, 573; taxonomy, 660
Thallassothia, 660
 Thames R., 464, 576; fauna, 442; fisheries, 481; pisciculture, 565
Thaumaturus, 628
Thelodus, 401, 663
Theology, 508, 605
Therapon, 375, 392; taxonomy, 649
 Thetford, 442
 Thian-Shan Mts., 436
 Thingvellir, 567
 Thorns (as hooks), 489
 Thread cells, 510
 Threadworms, 546
 Thresher Shark — see *Alopias*
Thricomycterus, 588
 Throat, 584
 Thrombocytes, 384
 Thunder killing fishes, 516
 Thunersee, 487
Thunnus — see *Thynnus*
 Thuringia, 534, 535
 Thursday I., 454
Thyestis, 663
Thymallinae, 633
Thymallus, 633; angling for, 371; in aquaria, 379; embryology, 415; size, 498; habits, 499; culture, 558, 562, 568, 569, 570
Thymus Glands, 383, 605
Thynnus, 384, 390, 404, 602, 652; anatomy, 369; angling, 371; eye, 418; fisheries, 474; migrations, 516; skeleton, 588, 590
Thyroid Gland, 388, 547, 605, 606; carcinoma, 547
 Tiber R., 448
 Tiberias, Lake, 439
 Tibet, 436
 Ticino R., 557
 "Tickling" Sharks, 490
 Tien-Tsin, 436
 Tierärztliche Hochschule, 547
 Tierra del Fuego, 433
 Tiflis, 450, 519
 Tiger Shark — see *Galeocerdo*, also *Stegostoma*
 Tignish, 425
 Tigris R., 439, 605
Tilapia, 374
 Tilefish — see *Lopholatilus*
 Timbo (fish poison), 489
 Timor I., 456
Tinca, 365, 384, 509, 587, 603, 636; anatomy, 369; in aquaria, 378; brain, 385; color, 393; habits, 499; hybrid of, 506; medical use, 514; parasites, 545; culture, 559, 564; skeleton, 589; spinal cord, 596; suprarenals, 598; variation, 610
 Tinetto, 535
 Tippecanoe Lake, 427
 Tirhoot, 436
Titanichthys, 665
 Titicaca Lake, 435
 "Toad-stones," 398
 Toadfish — see *Opsanus*
 Tobias Fish, 605
 Tobolsk, 517
Todarus, 369
 Tölz, 537
 Togoland, 538
 Tokio, 469, 517, 542
 Tolna, 480
Tomeurus, 377
 Tonga Is., 457
 Tongking, 436
 Tongue, 365
 Tongue-bone, 613
 Top-minnows, 404, 559 — see also *Cyprinodontidae*, and *Poeciliidae*
 Torbole, 567
 Torches used in fishing, 489
Torpedinidae, 620
Torpedo, 620; oesophagus, 365; anatomy, 368; in aquaria, 373; membranous labyrinth, 380; blood, 383, 384; brain, 387, 604; electricity, 388, 406, 407, 408; circulation, 389, 391; effect of curare, 407; medical use, 408, 514; embryology, 413, 414; lateral line, 511; nerves, 522, 523, 524, 526; reproduction, 582, 588; respiration, 583
 Torre d'Orlando, 538
 Torre di Zuino, 567
 Torres Straits, 453, 521
 Tortugas Is., 427
Torus longitudinalis, 387
 Totems, 521
 Touch, 525, 599
 Toulon, 566
 Toulouse, 445, 483, 566
 Toumen-Oula R., 438
 Toxins, 384
Toxotes, 375; water-throwing, 500; distribution, 648
Toxotidae, 648
 Trachenberg, 567
Trachichthyidae, 590
Trachinidae, 593, 594, 659
Trachinus, 393, 499, 609, 659; embryology, 410, 414; ova and larvæ, 572; poison apparatus, 573
Trachosteus, 665
Trachurus, 395
Trachycorystes, 378
Trachynotus, 652
Trachypteridae, 590, 660, 661
Trachypterus, 510, 660, 661; anatomy, 369; luminosity, 514; ova and larvæ, 571, 572; taxonomy, 661
 Track-wings, petrified, 513
Tradescantianum, Mus., 518
 Trans-Caucasia, 450, 541
 Transbaikalia, 535
 Transportation, 463, 469, 554, 555, 556
 Transvaal, 423
 Traps, 463, 490
 Trasimeno, Lake, 448, 567
 "Travailleur," 396
 Travel, 421 — see also Voyages, 343 f.
 Travemünde, 447
 Trawling, 463, 482
 Trebizond, 439
Tremataspidæ, 663
Tremataspis, 663
Trematoda (parasites), 544, 545

- Trematomus*, 580
 Tremiti Is., 541
 Trent, 480
 Trent R., 442
 Tres Marias Is., 432
 Treves, 447
 Triacanthidæ, 661
Triacanthus, 661
 Triassic fossil fishes, 534-535; exhibit, 519
 Trichiuridæ, 590, 593, **652**
Trichiurus, 652
 Trichodontidæ, 650
Trichogaster, 651
 Trichomycterinæ, 637
 Trieste, 468; Gulf of, 440
 Trifail, 540
 Trigemino-facialis complex, 523, 526
 Triggerfishes — see *Balistidæ*
 Trigger mechanism, 458
Trigla, **659**; anatomy, 369; brain, 385; fins, 461; locomotion, 512; migrations, 516; nerves, 525; pectoral girdle, 550; ova and larvæ, 572; spawning, 577; skull, 593; spinal cord, 596; barbels, 599; teratology, 604
 Triglidæ, 461, 496, 610, **658, 659**
 Trinidad, 431
Triodon, 590
 Tripoli, 423
 Tripolis, 439
Trisotropus, 649
 Tristan da Cunha I., 420
Tristomum (parasite), 545
 Trocadéro, salmon in, 630
Troglichthys, 643
Trogloglanis, **382, 383**, 406
 Troizkosavskii Lake, 438
 Trondhjems-fjord, 449, 470, 568
 Trophonemata, 581
 Tropical fishes, in aquaria, 373 f.; migrations, 515
 Trout, 365, 381, **628, 629**, 631, 632; angling, 371, 631; circulation, 391; color, 394; embryology, 409, 411, 412, 413, 549, 604, 605; fins, 461; food, 493, 564; growth and age, 497, 498, **629**; occipital region, 500; hearing, 501; hybrids, 507; liver, 512; muscles, 520; nerves, 522, 526; diseases and parasites, 546, 548, 549, 550, 559; pelvic girdle, 551; culture, 557, 558, **563, 564**, 565, 566, 567, 568, 569, 570; sperm, 595; spinal cord, 596; suprarenals, 598; tailless trout, 603; teratology, 603, 604; vertebral column, 612; reproduction, 631, **632**
 Truncus arteriosus, 503
 Trunkfishes — see *Ostraciontidæ*, 662
 Trunk muscles, 521
Trutta — see Trout, 628 f.
Trygon, 492, 552; wounds by, 574; viviparity, 581, 582; taxonomy and nomenclature, 620
 Trygonidæ, 620
Trygonorhina, 581
Trypanoplasma (parasite), 549
 Trypanosomes (parasites), 547, 549
 Trypanosomiasis, 549
 Trypsin, 403
 Tuba (fish poison), 490
 Tubercles, 459, 510
 Tuberculosis, 548
 Tubuai Is., 457
 Tüffer, 540
 Tuggurt, 421
 Tull's methods of castration, 555
 Tultcha, 450
 Tumors, 547
 Tuna — see *Thynnus*
 Tunica muscularis, 365
 Tunis, fauna, 423; fisheries, 475; palæontology, 536, 538, 540
 Tunny — see *Thynnus*
 Turbellaria (parasites), 545
 Turbot — see *Rhombus*
 Turga shales, 535
 Turkestan, fauna, 436, 438; palæontology, 539
 Turkey, fauna, 439, 453; markets, 468; fisheries, 488; pisciculture, 569
 Turonian series, 537
 Tuscany, 448
 Twait Shad — see *Clupea finta*
 Tweed R., 442, 443
 Twin Lakes, 426, 493
Tylosurus, 383, 576
 Tyne R., 442, 464
Typhlobagrus, 382
Typhlogobius, **382**, 509
 Typhoid transmission, 403
 Typhus epidemics, 548
Typlichthys, 643
 Tyrol, fauna, 440; fisheries, 480; palæontology, 534, 540; pisciculture, 565

Uaru, 374
 Ubangi R., 422
 Uelé R., 422
 Uganda, 421
 Ulcerative septicæmia, 548
 Ulcers, 547
 Ulricsdahl Palace Mus., 519
 Ultra-violet light, 601
 Umbilical cord, **413**, 588
Umbra, 642; in aquaria, 375; embryology, 415; habits, 499; breeding habits, 576; respiration, 583; hibernation, 602; confused with *Fundulus*, 642
Undina, 460
 Unionidæ (parasites), 544
 United States, 372, 373, 493, 516, 576; fauna, 424, **425** f.; fisheries, 462, 466, 467, 468, 471, 472, 473, **476-479**; markets, 468; museums, 519; palæontology, 531 f.; pisciculture, 556, 557, 558, 559, 561, 562, 563, 564, **569** f.
 Unter-Kirchberg, 541
 Upsala, 519
 Ural R., 438, 486, 563
 Uranoscopidæ, 659
Uranoscopus, 364, 369, 391, 499, 572; taxonomy, 659
 Urea, 389, 502
 Urethra, penetration by Candiru, 546
 Urine, 388
Urinogenital System, 361, 391, 503, 504, **606-610**; abnormalities, 603
Urolophus, 582
 Urostyle, 460
 Uruguay, 379, 435
 Urumiah, Lake, 438
 Usk R., 444
 Ust-Balei, 535
 Utah, fauna, 430; fisheries, 479; palæontology, 538; pisciculture, 557, 570
 Utah, Lake, 430
 Uterus, 580-582
Utriculus, 380

 Vaal R., 423
 Vagal lobes, 388
 Val d'Arno, 542
 Valdostani, Lake, 567
 Val-Saint-Germaine, 566
 Val Sordina, 539
 Val Trompia, 535
 Vale of Wardour, 535
 Valea Caselor, 540
 Valencia Harbor, 443
 Valencia I., 443
 Valencia, Lake, 435
 Valle Brembano, 535
 Van, Lake, 439
 Vancouver I., 424, 491
Vandellia, 546, 637
 Varano, Lake, 447, 506
 Varenna, 535
Variation, 491, **610**
 Vascular System — see *Circulatory System*
 Vassy, 536
 Velars, 548
 Veliferidæ, 590
 Velp, 568
 Vena cava, 391
 Vendace — see *Coregonus*
 Venern, Lake, 452
 Venezuela, 435, 479, 515
 Venice, 467, 518; Gulf of, 448
 Venous system, 389 f.
 Vent — see Anus, 366, 603

- Ventral arches, 458, 585, 591, 611
 Ventricle, 503
 Vera Cruz, 432
Verbascum (poisonous plant), 489
 Verdun, 536
 Vermont, fauna, 430; fisheries, 479; pisciculture, 563, 569
 Vernacular names, 600 — see also under the various countries
 Verona, 518, 567
 Vertain, 539
Vertebral Column, 368, 380, 457, 459, 465, 502, 591, 585, 601, **610-612**; age determined by, 496, 497; abnormal, 604
 Vertebral theory, 590, 591
Vesicula limpida, 510
Vesiculæ seminales, 609
 Vesicular tissue, 588
 Vespem, 534
 Vesuvius, Mt., 516
 Vettern, Lake, 452
Vexillifer, 643; adult form — see *Fierasfer*
 Victoria, fauna, 454; fisheries, 488; palæontology, 531, 542; pisciculture, 570
 Victoria Nyanza, Lake, 421
 Victoria R., 422
 Vienna, fisheries congresses, 463; museums and exhibits, 466, 517, 547; markets, 468; palæontology, 541; pisciculture, 565
 Vierwaldstättersee, 453
 Ville-sur-Saulx, 536
 Villedieu, 537
 Villers, 536
 Virgin Is., 431
 Virginia, fauna, 430; markets, 468; fisheries, 479; palæontology, 533, 534, 535, 537, 538, 540; pisciculture, 540
 Viscera, 498, 603, 604, 608
Visceral Skeleton, **612**, **613**; visceral arches, 365, 390, 520, 584, 586, 591, 592, 602, 605, 612, **613**; visceral muscles, 520, 521; visceral clefts, 613
Vision, 394, 419, **613**, **614**; in deep-sea fishes, 396; eye, **418 f.**
 Vistula R., 440
 Visual purple, 419
 Vitality, 502, 584, 601
 Vitelline body, 529
 Vitelline membrane, 528
 Vitellus, 412
 Viti Levu, 456
 Vitreous humor, 420
 "Vivier," 470
 Viviparity, 409, 506, **580-582**, 595
 Vivisection, 601
 Vizo, 540
 Vladivostock, 439
 Voice — see Sound
 Voiron, 538
 "Volcano fish," 637
 Volga R., 493, 515; fauna, 450; fisheries, 486; palæontology, 533; pisciculture, 563, 568
 Volpersdorf, 533
 Volterra, 542
 Volusia, 426
 Voracity, 574, 575
 Vorarlberg, 440
Voyages, **343-347** — see also under names of countries, and names of steamers
 Vraschi's method of impregnation, 555, 568, 595
 Vulcanism, 515, 516, 602
 Vyatka Govt., 451
 Wadi-Natrûn, 542
 Waigiu I., 455
 Wales, 548; fauna, 444; fisheries, 482; palæontology, 532, 533, 535; pisciculture, 565
 "Walking" with rays of pectoral, 512
 Walking Fish — see *Periophthalmus*
 Wall charts, 508
 Wallace's line, 405, 453
 Wallensee, 453, 487
 Walnut Lake, 428
 Walton-Naze, 539
 Wanstead, 542
 Waquoit Wier, 428
 Warberg-am-Elm, 535
 Wash R., 481
 Washington, fauna, 430; fisheries, 473, 479
 Washington, D. C., 463, 468; museums, 519; shad culture, 563
 Wasselnheim, 535
 Wassy, 537
 Water-throwing habit, 500
 Waterspouts, 575
 Waziristan, 436
 Weakfish — see *Cynoscion*
 Wealden fish-fauna, 537
 Weather, influence on migrations, 515
 "Weather-fish" — see *Cobitis*, 381
 Weberian apparatus, **380**, 381, 543
 Webi Shebeli (R.), 423
 Weever fish — see *Trachinus*
 Wehmingen, 535
 Weight — see Growth
 Weinheim, 540
 Weissig, 534
 Weitsee, 447
 Weldon, 563
 Wellington, 457
 "Wells" for transportation, 463
 Wels — see *Silurus glanis*, 636
 Wemmelian stage, 539
 Wernleiten, 539
 Weser R., fauna, 446; fisheries, 483, 554; pisciculture, 567
 Wesleyan Univ. Mus., 519
 West Africa, 579
 West Indies, 508, 574; fauna, 430; markets, 468; fisheries, 479; fishing methods, 491; palæontology, 538
 West Virginia, 430
 Westphalia, 405
 Wetterau, 446
 Wettin, 533
 Weymouth, 535
 Whale Shark — see *Rhincodon*
 Whales, 574, 605
 Whanganui R., 457
 Whitby, 442, 535
 White corpuscles, 384
 "White roach," 506
 White Sea, 420, 450
 "White spot" disease, 547
 Whitebait, 474
 Whitefish — see *Coregonus*
 Whiting — see *Gadus merlangus*
 Wickford, R. I., 469
 Wieliczka, 541
 Wight, Isle of, fauna, 441; palæontology, 537, 539, 540
 Wildungen, 532
 Wilhelmshöhe, 541
 Williamson's hatching trough, 554
 "Wind-eggs," 528
 Wind-fish — see *Semotilus*
 Winkelsmühle, 507
 Winnipeg, 424
 Winnipiseogee, Lake, 428
 Winter killing, 516
 Wisconsin, 493, 516, 544; fauna, 430; fisheries, 479; palæontology, 531; salmon introduced, 557; pisciculture, 570
 Witch — see *Pleuronectes cynoglossus*
 Wittingau, 565
 Wolffian duct, 606, **607**
 Wolf-fish, 660
 Woodhull Lake, 557
 Woodlark I., 456
 Woods Hole, fauna, 428; biological laboratory, 469; marking experiments, 516; cod culture, 561; breeding seasons, 576
 Woodwardian Mus., 517
 World's Columbian Exposition, 466
 World's Exposition, 466
 World's Fisheries Congress, 463

- Worms, parasitic, 544, 545, 546, 547
 Wrangelsburg, 516
 Wrasses — see Labridæ
 Wrassky — see Vrascki
 Württemberg, 528
 Würzburg, 535
 "Wundernetze," 390
 Wurzenegg, 540
 Wyandotte Cave, 427
 Wyoming, fauna, 430; palæontology, 530, 535, 538

 Xanthochroism, 394
 Xanthosis leuciscorum, 548
 Xenoberyces, 590
 Xenocara, 378
 Xenomystus, 379, 513
 Xiphias, 366, **653**; anatomy, 369; embryology, 415; eye, 418; skin, 509; cranial nerves, 525; ova and larvæ, 572; attack of, 574; gills, 585; fisheries, 653
 Xiphiidæ, 652, 653
 Xiphophorus, in aquaria, 377; color, 392; hybrid of, 506; viviparity, 582
 Xiphoramphus, 377

 Yaku I., 438
 Yale Univ., Triassic Coll., 519
 Yang-tze-Kiang R., 436, 564
 Yare R., 442
 Yarmouth, 481
 Yawning, 584
 Ybbs R., 439
 "Year-class," 496
 "Yellow fins," 629
 Yellow Perch — see *Perca*
 Yellowstone Park, 430
 Yenisei R., 438
 Yeniseisk, 480
 Yokohama, 437
 Yolk-sac, 383, 389, 410, 412, **413**, 528, **529**, 588; yolk-sac disease, 549; yolk-sac placenta, 581 — see also Embryology
 Ypresian stage, 539
 Ystad, 452
 Yucatan, 432, 580
 Yukon, 425

 Zagreb, 517
 Zambesi R., 423
 Zanzibar I., 423
 Zeidæ, 590

 Zell, 536
 Zeomorphi, 625
 Zeorhombi, anatomy, 369; habits, 499; ova and larvæ, 572; taxonomy, 653
 Zeugopterus, 657; burrowing habit, 500; eggs and larvæ, 654
 Zeus, 402, 609, **653**; ova and larvæ, 571, 572
 Zoarces, scales, 402; breeding experiments, 505; reproduction, 582, 609; double monstrosities, 605; pronephros, 609
 Zoarcidæ, 582; taxonomy and distribution, 660
 Zoogeography, 404
 Zoological Record, new genera and species in, 600
 Zürich, 467
 Zürich, Lake, 548
 Zugersee, 453, 487
 Zuni R., 425
 Zuyder Zee, 449, 470
 Zygaena — see *Sphyrna*
 Zygonectes, in aquaria, 377; viviparity, 582
 Zymogen, 403

